The chemical risk trail

Dr David Charles-Edwards, Brisbane

Introduction

Notwithstanding semantic issues, chemicals can be classed as being either "natural" or "synthetic". For present purposes, a "natural" chemical is defined as one that commonly exists in nature, and is present at a concentration commonly found in the natural environment. A "synthetic" chemical is one used in the processes and products of our society, found at concentrations relating to those processes and products. This contextual definition of a chemical allows us to distinguish between a natural "chemical" present in an environment in its natural quantities and the same chemical present in the environment in unnatural, and perhaps harmful, quantities as a consequence of human activity.

Over the last two hundred years we have been releasing increasing numbers and quantities of chemicals into our environment. The impacts that chemicals are having on our environment is never far from the news. We are all familiar with the debates on chemical pollution and, for example, the debate on the levels of carbon dioxide emission, a "natural" chemical produced in unnatural amounts by industrial activity, and the "Greenhouse Effect". When I started as a researcher in the Plant Sciences some thirty years ago the concentration of carbon dioxide in the atmosphere, its "natural" concentration, was taken to be between 290ppm and 300ppm. Today it has risen to between 320ppm and 330ppm. This "unnatural" rise in the atmospheric carbon dioxide concentration, primarily a consequence of human activity, may have profound effects on our climate and thence on the well being of our society.

It is probably a truism that all the "natural" and "synthetic" chemicals with which we come into contact, the chemicals that surround us, are potentially toxic, and that from time-to-time each one of us experiences an adverse reaction to some chemical in our environment. Whereas high pollen counts, derived from an endemic, native flower, may cause considerable respiratory distress to residents in a particular area, we are obliged to accept the distress it may cause us as "a part of life". However, if the distress is perceived to result from fumes generated by a factory we seek redress for our discomfort from the factory owner.

A "duty of care" is integral to many aspects of legislation. For example, the *Environmental Protection Act 1994 (Qld)* explicitly identifies a general duty of environmental care on all citizens that requires:

"... a person must not carry out an activity that causes, or is likely to cause, environmental harm unless the person has taken all reasonable and practicable measures to prevent or minimise the harm".

In seeking redress for our discomfort we must demonstrate, on the balance of probabilities, that a specific "synthetic" agent was the cause of our discomfort and that our exposure to it was a result of the user or producer of it neglecting their "duty of care".

The advocate is therefore concerned with those "synthetic" chemicals present in the public environment as a consequence of some identifiable human activity and the responsibilities incumbent on those pursuing that activity. When representing a client seeking redress for a perceived adverse reaction to some "synthetic" chemical in their environment the advocate therefore has two tasks. Firstly, the probable cause of the adverse reaction must be demonstrated. Secondly, it must be demonstrated that "all reasonable care" was not taken in its use and/or disposal. The advocate needs to address the distinct tasks of "identification" and "audit". In this article I briefly examine the issues that must be addressed in these two tasks.

Identification

There are several steps that must be taken in identifying an association between a "synthetic" chemical and an illness, and these are outlined below.

(1) Major, identifiable chemical pollution events, such as the Bhopal disaster, are fortunately infrequent. More often the initial evidence of an adverse chemical event is largely subjective. It is no more than a claim by a client that "when the wind blows from factory I get asthma" or "the smell gives me a headache and makes me dizzy". Occasionally, published health records may suggest that there is an abnormal incidence of specific types of illness, say cancer, asthma or gastric upset, at a particular location over a particular period of time.

The first task is to obtain corroborative evidence of the claim. If sufficient evidence is obtained, epidemiological studies may be able to demonstrate a statistically significant association between a location and period of time and the reported illnesses. Whilst documented public records are more amenable to objective, rigorous statistical analysis than unrecorded complaints, in both cases the costs of field work and statistical analysis are likely to be high and their outcomes may be unclear and contentious.

Consider two examples. Firstly, there is presently an on-going debate on the thesis that there is an association between the distance of a dwelling from a high-tension power line and the risk of its occupants contracting cancer. Whilst some epidemiological studies appear to show such an association others do not, and the evidence is equivocal. Secondly, it has recently been reported that there is an unusually high incidence of leukemia in children who have a father working at a nuclear reprocessing plant. The scientific argument is centred on the thesis that damaged chromosomes in the father's sperm may predispose their children to leukemia. Both these examples raise a fundamental issue of evidence. The scientific investigator is primarily concerned with showing a statistically significant association between an alleged cause and an observed effect, whereas the advocate is concerned with showing that "on the balance of probabili

ties" the alleged cause gave rise to the observed effect. Whereas the scientific investigator is necessarily more concerned with the mechanism that might lead to the association between cause and effect, the advocate is often more concerned with eliminating other potential causes of the observed effect.

Notwithstanding the extent of statistical evidence of an association between an illness and a location and a particular manufacturing process or a product, qualitative evidence of an association may be sufficiently compelling for the advocate to proceed with their investigation.

(2) If there appears to be a strong association between an alleged cause and an observed effect we need to start to assemble and collate all relevant background information. Clearly, the first step is to identify the potential causative agent(s).

In the case of a major incident, such as a fire at a chemical plant (e.g. Bhopal) or nuclear plant (e.g. Chernobyl), with the subsequent poisoning of a significant number of people living near to the plant, establishment of a probable cause-and-effect association is fairly straightforward. However, in the case of intermittent, non-notifiable illnesses reported in the neighbourhood of say a small industrial plant, a potential cause-and-effect relationship may be more difficult to establish.

The toxicity of chemicals, and the time over which symptoms attributable to them appear, vary. Some chemicals, in relatively small amounts, can have rapid effects on the human body whilst others have more insidious effects emerging over a long time period. For example, the inhalation of relatively low concentrations of hydrogen cyanide gas can cause rapid, and sometimes terminal, distress. In contrast, the ingestion of lead, even in low concentrations, can lead to its accumulation in body tissues, with symptoms of poisoning appearing over, or after, an extended period of time. These two examples were not chosen lightly. Hydrogen cyanide gas is a common combustion product of many synthetic materials, particularly those made using formaldehyde-urea resins. Lead was, before the introduction of lead-free paints and petrol, a common "synthetic" chemical in the urban environment.

Some common "synthetic" chemicals can pre-dispose people to illness. For example, formaldehyde, used widely in manufacturing particleboard and fibreglass, can sensitise people to other respiratory irritants. Moreover, a volatile substance, like formaldehyde, can de-gas from a manufactured product, and there are published studies attributing the "sick building" syndrome to formaldehyde vapour de-gassing from particleboard paneling used in building construction. Other chemicals can act anergistically with common medications. For example, cold and flu medications containing pseudoephradine, sold over-the-counter at all pharmacies, can be dangerous to people taking medicine to relieve hypertension.

In the first instance the advocate needs to demonstrate that a "synthetic" chemical produced, used or disposed at the location being challenged, is capable of causing the symptoms reported by the client.

(3) The next task is to establish how the client could have contacted the identified chemical, and how it could have entered the client's metabolism. Chemicals can enter the human metabolic pathways by one of three routes. They can be ingested, inhaled, or absorbed through the skin.

The client could have ingested the chemical in a number of ways, with food eaten or liquid drunk. For example, dusts or aerosols could have contaminated uncovered food left on an open surface, "synthetic" chemicals could have polluted ground water supplies used for drinking water and ingested directly. If the client ate garden vegetables, grown on contaminated soils, these vegetables could have accumulated the chemical.

The client could have inhaled the chemical either as a vapour, an aerosol or absorbed onto dust particles. For example, aerosol droplets produced by high pressure sprays, often used to dispose sewage effluent to land, can travel quite long distances. Dust, and smoke particles, contaminated with a potentially toxic chemical also travel long distances.

Absorption through the skin requires direct, primary contact between the client and the chemical. The chemical might be absorbed on the soil in the client's garden, or on clothing worn by the client.

Clearly, the advocate needs to demonstrate that there has been an opportunity for contact between the alleged agent and the client. If such an opportunity can be demonstrated it clearly needs to be established whether the contact was in any way due to the negligence of the producer, user or disposer of the agent.

(4) When compelling evidence that an adverse "event" has occurred, attributable to a "synthetic" chemical, and a potential route for exposure of the client to the chemical has been identified the alleged "cause-and-effect" needs to be documented. A background literature search needs to be undertaken to confirm the plausibility of the trail, identify known hazards of the "synthetic" chemical and appropriate and acceptable procedures that should be in place to minimise the risks of exposure of the public or workforce to those hazards.

Audit

The audit is an integral element of establishing whether or not the producer, user or disposer of the alleged agent has fulfilled their "duty of care". When a probable cause of the client's distress, and a route of poisoning, has been established the advocate needs to audit the alleged source of the presumed toxic agent.

There are several steps in this audit process, and these are briefly described below.

(1) The first step in the audit process is to use key information obtained during the identification phase to pose informed questions to the individual or company thought to be responsible for the "event". These may relate to manufacturing, storage or disposal procedures.

The advocate needs to know the types and quantities of chemicals used in processes, contained in products and their disposal. It may seem trivial, but it must be established that the "synthetic" chemical under suspicion is used in the manufacturing process, or the product, and could be released into the environment in concentrations sufficient to cause the adverse effects being investigated.

(2) The second step in the audit process is to establish the procedures employed to minimise the risks of the agent escaping into the natural environment. Knowledge of these procedures will assist to establish whether those responsible have fulfilled a proper "duty of care".

(3) If a potentially toxic chemical is used, or produced, in a particular industrial activity it is incumbent on the producer to be able to provide an account of the quantities and fate of that chemical. For example, for many years laboratories using radioactive tracers have been required to maintain records of their usage and disposal. These records are audited to ensure that all radioactive material can be accounted for and no health risks exist resulting from their inappropriate handling and disposal.

In the case of any potentially toxic waste products of a manufacturing or other industrial process the audit must extend to the amounts and methodology of disposal of the waste products. In many cases their disposal will be regulated by law, and the person or organisation responsible for their disposal should be able to demonstrate their compliance with that legislation.

(4) When the evidence has been compiled and it can be demonstrated that a specific "synthetic" chemical was, on the balance of probabilities, the cause of the distress for which redress is being sought, it remains to be established whether or not a "duty of care" was broached. If there has been some flagrant disregard of legislation, enacted to protect the public or workforce from known dangers, the proof of a failure in duty of care should not be onerous. But what do we do if no legislative protection exists, perhaps because the "synthetic" chemical is new, or is being used in a novel way or for a novel purpose? In these situations a key element in establishing the diligence with which a duty of care has been undertaken will be an analysis of the risks associated with the substance.

Depending upon the circumstances, an analysis of risks can be either qualitative or quantitative. For example, consider the position of a domestic water supplier. We all know water, a "natural" chemical necessary to our very existence, can be dangerous. Every day we each use about 400 litres of potable water. Only about 10% of that water is drunk or used in food preparation. The rest is used for washing, toilet flushing, laundry and in the garden. Each year there are a number of reports of people drowning in their bathtubs. Clearly the very act of reticulated water to a home creates a finite risk of injury or death. However, we would all concur that the provision of reticulated water to each home is an acceptable, qualitative risk for which the supplier is not liable.

Only a very small part of the water provided to the home is used for drinking and cooking. However, we would all agree the quality of the water supplied to us should be such that the risk of us contracting some illness from consuming it is negligible. To satisfy their duty of care the supplier of reticulated, potable water has three tasks to complete. Firstly, they need to establish the risk to human health, and the acceptability of that risk, resulting from the quality of the water leaving their water treatment plant. Secondly, they need to establish the risk, and the acceptability of that risk, of the treated water becoming contaminated with substances, both chemical and microbiological, whilst in the reticulation main. Thirdly, they need to show that where an unacceptable risk has been identified they have implemented "best practice" measures to minimise it. If some form of risk analysis, either qualitative or quantitative, has not been undertaken, it could be argued that a duty of care has not been properly fulfilled.

Summary

The task of identifying the probable cause of client's distress requires:

- the identification of a probable causal "synthetic" chemical;
- a mechanism for contact;
- the presence of the "synthetic" chemical at the appropriate location and time.

The task of auditing the perceived source of the chemical requires:

- establishing its presence, and the quantities present;
- confirming a potential mechanism of contact with the client;
- identifying that all legislative requirements have been met;
- identifying whether an appropriate "risk analysis" has been undertaken to fulfil the duty of care. ■

Dr David Charles-Edwards is the Director of SCI-PLAN Pty, PO Box 1327, MILTON, QLD 4064
phone 07 3368 3077 **fax** 07 3368 3177
email Sci-Plan@tlaq.com.au

AFL star's $90,000 injury payout breaks new ground

BENJAMIN HASLEM

FORMER Australian rules football star Phil Krakouer yesterday received $90,000 in an out-of-court settlement with the AFL, MCG Trust and his former club North Melbourne over a serious knee injury he sustained playing at the MCG in 1989.

The settlement is believed to be the first time an AFL player has been compensated by the league after taking a case to court over an injury sustained while playing.

Krakouer's barrister, Dyson Hore-Lacy QC, said the result would send out a warning to all sports administrators that they carried the same responsibility as any employee to provide a safe workplace.

Krakouer and his brother Jimmy formed a celebrated combination at North Melbourne in the mid-1980s, dazzling football fans with their skills.

But on July 23, 1989, Krakouer severely injured his left knee during a match against Fitzroy (now merged with Brisbane) at the MCG.

Krakouer had been running for the ball when his feet became stuck in mud and he injured his knee.

His career then declined.

At the end of 1989, he moved to Footscray (now the Western Bulldogs) where he played seven games. He was drafted by Sydney in 1992, but only played for the reserves.

Yesterday's $90,000 payout was compensation for pain and suffering and future economic loss, Mr Hore-Lacy said.

He said he believed the settlement was the first in which a Victorian elite athlete had successfully recovered money for an injury from a sporting body.

"The lesson is that all sporting organisations should be insured," Mr Hore-Lacy said.

"If they continue to provide unsafe surfaces they'll continue to get sued."

Mr Hore-Lacy said he had not spoken to Krakouer but predicted he would be "very pleased" with the outcome.

"I think Phillip's made a point, the condition of the MCG was absolutely atrocious on the day and one of the interesting things is they have a similar problem at the moment," Mr Hore-Lacy said.

"Unlike in 1989, when they had people running off firm ground into a quagmire, now they have people running off firm ground onto a skating rink," he said referring to recent criticisms of the hardness in the MCG centre square.

AFL communications manager Tony Peek described yesterday's settlement as "a sensible commercial outcome" and dismissed suggestions it would encourage other injured players to follow in Krakouer's footsteps.

AFL Players' Association chief executive Andrew Demetriou said his organisation recently teamed up with the AFL Medical Officers Association to set up a standardised "ground-hardness" to prevent injuries.

"It's a step in the right direction," he said.