



Government ignorant of safety risks surrounding energy-saver light bulbs

A Labour and Green Party initiative to ban ordinary incandescent light bulbs if they win the election could cost ordinary households thousands of dollars and have major safety implications for children and pregnant women. **IAN WISHART** has the story about new energy efficient light bulbs that the Government has kept off the public radar

We've all heard the marketing spin about so-called "energy-saver" light bulbs: they last seven times longer than an ordinary bulb, they use only a fifth of the power. In theory, compact fluorescent lights are the way of the future, a solution to soaring energy wastage and a sure-fire way to go green in the home and save cash doing it. In theory.

Sometimes what looks good on paper turns out to be not so flash in practice, and when politicians get involved it can be a recipe for disaster.

When Labour's Energy Minister David Parker and the Green Party's Jeanette Fitzsimons issued an order last month to ban the use of ordinary light bulbs in homes from next year, the news media were quick to paint it as another step towards saving the planet, faithfully spinning the government line.

"New Zealand will ban traditional light bulb sales from October 2009 to cut greenhouse gas emissions and save up to half a billion dollars in energy costs over 12 years," reported Newstalk ZB News breathlessly.

"The traditional light bulb is very old technology and very inefficient. Only five per cent of the energy it uses generates light – the rest is wasted as heat," Associated Press quoted David Parker in a statement, apparently missing the point that heaters may have to be used more if we switch to cold lights.

On the surface, it should have been another glittering PR moment for the Government in its battle to be seen as a climate change leader. But then again, this is the same David Parker whose climate change policy was secretly being written by Heather Simpson in Helen Clark's office, as revealed by whistleblower Erin Leigh in the book *Absolute Power*. Leigh revealed the policy required constant re-drafts because Simpson didn't have her head around the issues, and was concentrating more on the politics than the substance.



AT A GLANCE

MERCURY VAPOUR US authorities don't recommend use in children's rooms or over carpeted areas because of toxic hazard

DAMAGE TO HOUSES Despite NZ government assurances, the latest scientific tests in the US prove the mercury in one broken bulb can irreparably contaminate a carpet. In the US insurance companies are refusing to cover the cost of replacing carpets

FIRE RISK It is normal for CFL bulbs to physically burn up at the end of their natural life. Although rare, in some cases this has led to house fires

TOXIC SMOKE The burnt plastic and gases emitted when lights burn out are carcinogenic

LIFESPAN Although many bulbs claim 6,000 hours (five years' use) or greater, this is based on ideal laboratory conditions. Some bulbs have died within 12 months in household use

RF INTERFERENCE Household CFLs are widely known to cause interference to wireless networks, electronic appliances, hot water cylinders and cordless phones

POWER DISRUPTIONS NZ Government briefing papers disclose major concerns that CFLs could cause regular widespread power outages because of a peculiar side-effect known as harmonic distortion

COST OF DISPOSAL Some US states now require homeowners to drive old CFL bulbs to a special recycling centre to avoid contaminating the environment

Photography: MARK SCOWEN

There are suspicions the light bulb policy may suffer the same limitations. Before you read any further, however, here's a figure to keep in mind:

"The energy saving potential is of the order of 6% of domestic sector electricity use, or 2% of total electricity use," top science consultant David Cogan has told the New Zealand government in a briefing paper.¹ Remember that figure: the banning of ordinary light bulbs will reduce total electricity demand by 2%. The question is, after you've read the full story, whether you think Labour and the Greens' plan to save 2% is worth the effort.

THE MERCURY ISSUE

Perhaps the most serious issue for householders arising out of next year's compulsory switch to predominantly CFLs is their mercury content. So far, the New Zealand Government has played this aspect very low key.

The Ministry for the Environment, found guilty last year of letting political appointees write its briefing papers instead of independent public servants, has posted this claim on its website:

"Energy saving lamps contain a small amount of mercury which makes them operate much more efficiently than incandescent and halogen lamps. Mercury is toxic to human health and bioaccumulates [Bioaccumulate – the accumulation of a substance, such as a toxic chemical, in various tissues of a living organism.] in the environment but the amount inside an individual lamp is not large enough to pose a hazard to users."²

The spin is clear. The lamps are "energy saving", it is only a "small amount" of mercury, which makes the lights operate "much more efficiently". Importantly, on the safety side, the Ministry for the Environment assures New Zealanders that "the amount...is not large enough to pose a hazard to users".

That is the official NZ Government position. Now let's examine the reality.

In March last year, Brandy Bridges, a mother in the town of Prospect, Maine, in the US, heard the publicity about the new energy-saver light bulbs and went out and purchased two dozen of the CFLs for the family home.

While installing one in her young daughter's bedroom, Bridges accidentally broke the new CFL bulb, which shattered and fell to the carpet.

Remembering that the bulbs contained a trace amount of mercury, she called around for advice, eventually hitting the Maine Department of Environmental Protection (DEP) who suggested she call in a hazardous waste crew. When the hazard contractor quoted US\$2,000 to clean the bedroom, Bridges decided simply to seal off the room and make her daughter sleep elsewhere in the house while the issue was sorted out. (See sidebar feature for Brandy's story)

As publicity from the unfortunate event spread across America, it quickly became apparent that neither the US Environmental Protection Agency (EPA) nor anyone else had up to date information on the hazards of household CFLs.

Not to be beaten, the Maine DEP called in its own science team to run some experiments on broken CFLs. The DEP team smashed dozens of bulbs in a series of tests to see just how much mercury they

emitted, and how much was left in the environment after various clean-up scenarios were tried. The experiments were conducted over bare floors, and carpeted floors.

The study team reported back just a few months ago, in February 2008, and the findings in their massive 160 page report have stunned US safety authorities.

First off, the often-cited claim that bulbs contain only 5mg of mercury was clarified: it's an average.

"Without the mercury, the lamp would not produce visible light. The average amount of mercury in a CFL is 5 mg with a range of 0.9 to 18 mg."

Obviously, the smaller (in watts) the bulb, the less mercury. Higher power (brighter) bulbs generally have more, although there can be fluctuations between brands as well.

One busted bulb in a bedroom produced very disturbing results in their tests.

"Mercury concentration in the study room air often exceeds the Maine Ambient Air Guideline (MAAG) of 300 nanograms per cubic meter (ng/m³) for some period of time, with short excursions over 25,000 ng/m³, sometimes over 50,000 ng/m³, and possibly over 100,000 ng/m³ from the breakage of a single compact fluorescent lamp," the report confirms.

That's up to 300 times higher than the recommended safe level of inhalable mercury vapour. From just one light bulb.

What was it that New Zealand's Ministry for the Environment said?

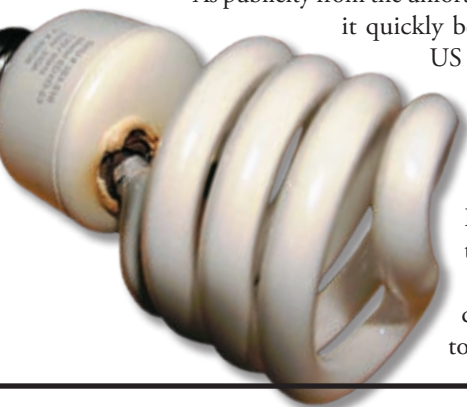
"The amount inside an individual lamp is not large enough to pose a hazard to users."

As if to put the lie to that claim well and truly, when Maine DEP scientists went back to Brandy Bridges' house some three months after the breakage, they found mercury contamination in the bedroom was still as high as 2000 ng/m³ – *three months later and despite following all the cleanup recommendations.*

In the end, the DEP ripped out her carpet and disposed of it as toxic waste. And little wonder. According to the DEP scientific study, while the 300 ng/m³ limit is the maximum allowable daily dose of mercury for the sake of legislation, there is in fact no known safe level for mercury exposure.

"The Maine Ambient Air Guideline (MAAG) of 300 ng/m³ is identical to the EPA reference concentration (RfC), which is designed to protect against chronic exposure. The RfC is based on a number of occupational studies, in which tremor, fine motor deficits, electroencephalography (EEG) and autonomic nervous system abnormalities, and cognitive deficits were observed.

"A no-effect level (the level at which no adverse affects are





“Mercury exposures have serious impacts on fetal and infant brain development. Elemental mercury can cross the placenta from a mother to fetus

observed) was not identified in these studies.”

To make matters worse, scientists believe the 300 ng/m³ limit may not protect children or infants.

“Sensitive populations are of particular concern with mercury exposures for a number of reasons. Mercury exposures have serious impacts on fetal and infant brain development. Elemental mercury can cross the placenta from a mother to fetus. For these reasons, acute peaks could be particularly problematic during pregnancy. Infants and toddlers have much more vulnerable brains.

“Neurotoxicants identified in adults may have different and more severe effects in developing organisms. Infants and toddlers also have a much higher rate of respiration than adults. Therefore they have a higher exposure to similar concentrations. They also are lower to the floor and therefore closer to the source of the exposure and presumably more apt to obtain a concentrated dose of mercury.

“Elderly and unhealthy individuals may already be at comprised health and be more susceptible to mercury effects than a healthy

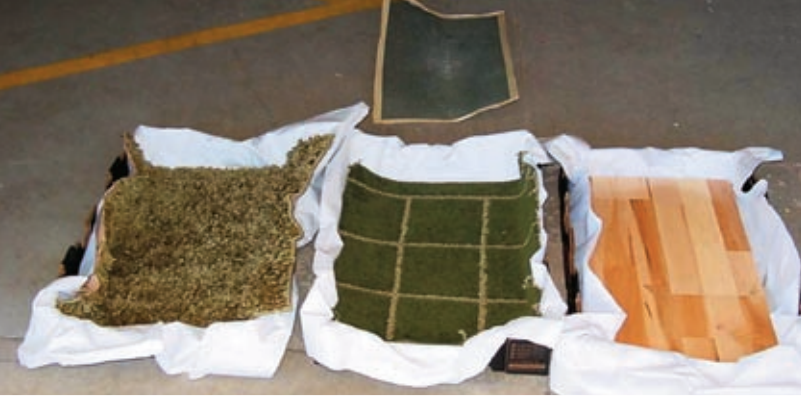
individual. For example, mercury does kidney damage which could exacerbate an already existing kidney disease.”

Additionally, pregnant women exposed to a broken CFL light bulb could literally destroy their baby, in the wrong circumstances:

“It is well established that the developing organism may be much more sensitive than the adult to neurotoxic agents,” reports Maine’s DEP study. “For example, methylmercury exposure can produce devastating effects in the fetus, including cerebral palsy, blindness, deafness, and even death, while producing no or minimal effects in the mother.”

The problem for New Zealand’s Ministry for the Environment is that its own reassuring public comments about disposing of broken bulbs were not based on any safety study. The Maine study is believed to be the first of its kind, and it was only published in February this year. New Zealand authorities appeared to be unaware of it when *Investigate* contacted them.

On its own website³, the US Environmental Protection Agency



says it is now undertaking a “full review” of the Maine study with a view to updating its own recommendations on how to deal with CFL breakages in the home.

And it’s not as if the EPA was already limp-wristed on the subject.

“Never wash clothing or other items that have come in direct contact with mercury in a washing machine, because mercury may contaminate the machine and/or pollute sewage. Clothing that has come into direct contact with mercury should be discarded,” warns the EPA.

By “direct contact,” the EPA is referring to clothes you were wearing if you happen to break a bulb while installing it, or if you were underneath it when it broke. If that happens, your clothes must be thrown out, in a sealed plastic bag, immediately.

If you attempt to clean up the broken light bulb, you can keep the clothes you are wearing, but only if they don’t come into direct contact with lightbulb fragments or powder. Those clothes can be washed, but should be done so separately from other clothes. Whilst it is vital that your skin does not come into contact with the residue, that means you may also be up for the cost of a new pair of shoes.

“Never walk around if your shoes might be contaminated with mercury. Contaminated clothing can also spread mercury around,” warns the EPA.

Another no-no is vacuuming. Although it might suck up glass fragments and powder residues, the mercury vapour molecules are so small the vacuum cleaner spits them back out through the exhaust into the whole atmosphere of the house, dramatically increasing the area of mercury contamination. Additionally, “agitating” the carpet via vacuuming or sweeping or even walking or playing on it throws more mercury back into the air and into your lungs.

“Never use a vacuum cleaner to clean up mercury,” says the EPA. “The vacuum will put mercury into the air and increase exposure.”

The Maine DEP study found there were three crucial areas of mercury exposure from a broken bulb:

“This study identified several potential exposures from the breakage of a CFL. The first is the air concentration from the initial break and cleanup. The next is the source left in the flooring surface. This ongoing emission affects both those using the surface in close contact and sometimes those more distant from the flooring, especially when the floor is agitated. The final piece is the emissions from the broken lamp debris once cleaned up. The three different potential mercury exposures each impact guidance for appropriate handling of a broken CFL.”



“All types of flooring surfaces tested can retain mercury sources even when visibly clean. Flooring surfaces, once visibly clean, can emit mercury immediately at the source that can be greater than 50,000 ng/m³”

The report also noted that following official clean-up guidelines was still not good enough to eliminate the pollution.

“Although following the pre-study cleanup guidance produces visibly clean flooring surfaces for both wood and carpets (shag and short nap), all types of flooring surfaces tested can retain mercury sources even when visibly clean. Flooring surfaces, once visibly clean, can emit mercury immediately at the source that can be greater than 50,000 ng/m³. Flooring surfaces that still contain mercury sources emit more mercury when agitated than when not agitated.

“This mercury source in the carpeting has particular significance for children rolling around on a floor, babies crawling, or non mobile infants placed on the floor.

“Cleaning up a broken CFL by vacuuming up the smaller debris particles in an un-vented room can elevate mercury concentrations over the MAAG in the room and it can linger at these levels for hours. Vacuuming tends to mix the air within the room such that the one foot and five foot heights are similar immediately after vacuuming. A vacuum can become contaminated by mercury such that it cannot be easily decontaminated. Vacuuming a carpet where a lamp has broken and been visibly cleaned up, even weeks after the cleanup, can elevate the mercury readings over the MAAG in an un-vented room.”

In fact, the data showed that *three weeks* after the breakage had been cleaned to EPA standards, one vacuuming could send mercury levels in the room back up to 12 times higher than the maximum safe level, and keep them there for hours – cold comfort if you have kids in your house, and a major risk to your vacuum cleaner.

Additionally (and this is why carpets have to be destroyed), the scientific team repeatedly vacuumed carpets where bulbs had broken, to see if vacuuming did eliminate the residue. They found that even after several attempts, the mercury was still trapped in the carpet fibres. To make matters worse, some of the vacuum cleaners were so contaminated that cleaning them was impossible, meaning not only was the carpet over and out, so was the vacuum cleaner.

Then there's the problem of what to do with the toxic waste.

Apparently ignorant of the latest American studies, New Zealand's Ministry for the Environment is reassuring the public that a broken CFL is not a major problem:

"If your fluorescent lamp breaks, your greatest risk is being cut by broken glass. As a precaution, we advise you to wear gloves when handling the broken lamp and open doors and windows to ventilate the room. Put the broken pieces in a plastic bag then wrap with paper to prevent cuts. Wipe the area with a damp paper towel to pick up any smaller shards of glass, powder or liquid. Dispose of the paper towels, gloves and any cloths used to clean the area by placing in a plastic bag with your household rubbish," recommends the New Zealand government.

But the most up to date safety study available says plastic bags are next to useless for containing a broken CFL bulb.

"Double re-sealable polyethylene bags... did not appear to retard the migration of mercury adequately to maintain room air concentrations below the MAAG... The significance of this issue is that cleanup material may remain in the home for some period of time and/or be transported inside a closed vehicle, exposing occupants to avoidable mercury vapors when improperly contained," report the Maine scientists. The best method of containing bulb waste is inside a glass jar with a hermetically sealed lid.

Surprisingly, plastic jars, like large peanut butter containers with screw top lids were little better than plastic bags, also failing to prevent mercury vapour from leaking into the house.

The scientific experiments proved that debris "sealed inside *two* polyethylene plastic bags and then placed in a clean room", sent atmospheric mercury levels up to more than three times the maximum allowable limit, for more than eight hours – the mercury vapour simply leached out of the bags into the air.

"Of the 12 different types of containers tested during the 23 different tests, the plastic bag was found to be the worst choice for containing mercury emissions. Based upon this study, the DEP now suggests that a glass container with metal screw lid with a gum seal be used to contain debris."

All of which means the current disposal advice given by New Zealand's Ministry for the Environment is dangerously faulty, based on the most recent scientific studies. If a bulb breaks, disposing of it in two plastic bags will not prevent it from poisoning your house. Only a glass jar with a hermetically sealed screw-top lid is safe enough to hold the debris.

The US scientists say it is possible that one single "spike" dose of mercury could be enough to damage a baby or a child's brain, even if there is no further ongoing exposure. With the experiments showing a 20 watt CFL (equivalent to 100 watts ordinary) bulb can produce a spike of 100,000 ng/m³ of air, 300 times the recommended allowable maximum, this could be a major safety problem with making CFLs the light of choice when ordinary bulbs are banned.

"An important issue for which there are no data is the relative importance of a short spike in exposure versus a longer-term lower exposure in producing toxicity," says the Maine report. "The U.S. EPA considers that a single exposure may be sufficient to produce effects in a developing organism because of the recognition of potential critical windows of vulnerability. This implies that any exposure over an accepted toxicity value is potentially cause for concern, since a single exposure may produce a perturbation in a single or multiple processes in discrete brain areas, depending on the developmental stage of the exposure. Any such perturbations



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may have “downstream” consequences: if A doesn't happen, then B and C cannot happen in a normal manner.

“Repeated exposures would presumably increase the probability of untoward consequences. In addition, the relative risk of various exposure metrics is unknown: whether the greatest risk is posed by short-term higher level peak exposures or by the total area under the curve including higher and lower exposures.”

To further muddy the waters, the scientists note that the mercury contamination was considerably worse – nearly double in fact – at summertime temperatures (32C) than winter (23C).

To put the exposure in perspective, a study⁴ of workers who had been exposed on a regular basis to 33,000 nanograms/m³ of mercury (roughly a third of the 100,000 ng/m³ peak caused by a broken bulb), and compared in a neurological test to a control group of 70 unexposed people, found they scored worse on “mental arithmetic, 2-digit search, switching attention, visual choice reaction time and finger tapping”.

A similar study of dentists, where the atmospheric readings in their offices were 16,000 ng/m³, found similar drops in mental capacity.⁵

As a result of the Maine scientific study on CFL breakages, major changes have been made in recommendations around the use of CFL light bulbs.

For a start, the study recommended ripping out carpets exposed to a broken CFL bulb, in order to protect the health of pregnant women, infants, children and the elderly or infirm:

“Mercury sources left in the carpets, the mercury levels in the air that this can cause in certain circumstances, and the potential to irreversibly contaminate the vacuum are all factors that point toward removal of the carpet section where the lamp has broken. This is the

easiest and surest means of eliminating the mercury source that remains in the car-



pet. We realize this is unpleasant and could be the source of controversy. However, it seems the surest means of eliminating avoidable mercury exposure.”

Formally, they reported, homeowners should be strongly encouraged to arrange the “removal of carpeting sections where breakage has occurred as a precaution in some situations, particularly in homes with infants, small children or pregnant women.”

Sadly for homeowners in the US, and here in New Zealand, insurance companies won't be covering the cost of replacing your carpet if a new energy-saver bulb breaks. You're on your own and it could cost thousands of dollars. Nonetheless, that's now the official recommendation in the US state of Maine, and may become the national standard in the US.

If a mercury bulb breaks in your house, US officials now recommend opening windows immediately and evacuating the room behind closed doors for 15 minutes before attempting to clean up (if you leave it too long after that, however, the mercury can penetrate more of the surrounding area).

“In addition, data from this study suggest that venting should continue for several hours after a lamp cleanup to be conservative.”

In other words, be prepared to leave your windows open, even in winter, for up to six hours to allow as much mercury vapour to dissipate as possible. And even if you do, it still won't be enough to clear the air.

The lack of proper safety information in New Zealand has been thrown into stark relief by the comments of Lighting Council CEO Richard Ponting to the *NZ Herald* on June 21st this year.

Asked if the mercury in CFLs is dangerous, Ponting gave this response:

“No. A current generation CFL has probably got less than five milligrams or about the size of the end of a ballpoint pen... The type of mercury in those lamps is in a semi-solid state. It's quite soft and it doesn't exist as a vapour after the lamp is broken or when the lamp is cold.

“You can't inhale it.”

Make of those reassuring comments what you will, but they differ strongly from the results of Maine's groundbreaking scientific study. Convinced it must have been an error by the newspaper, *Investigate* asked Ponting to clarify.

“The mercury can only exist as a vapour after the lamp has been switched on and warms up,” he reaffirmed. “If the lamp is broken when it's cold you can poke it around with a matchstick, the mercury is in a solid, globular form. It only exists as a gas once the lamp is hot.”

Ponting was in disbelief when we read out key portions of the Maine report revealing mercury vapour readings from lamps broken while cold.

“I'd like to see that study. What do they say about fluorescent tubes? The technology behind CFL lamps – the generation of UV

“Sadly for homeowners in the US, and here in New Zealand, insurance companies won't be covering the cost of replacing your carpet if a new energy-saver bulb breaks. You're on your own and it could cost thousands of dollars”

Additionally, the Maine state government is now officially recommending that CFL bulbs are NOT used over carpeted areas, or where children play. Formally, the guidelines are that “homeowners consider not utilizing fluorescent lamps in situations where they could easily be broken, in bedrooms used by infants, small children or pregnant women, or over carpets in rooms frequented by infants, small children or pregnant women.”

“If clothing or bedding materials come in direct contact with broken glass or mercury-containing powder from inside the bulb that may stick to the fabric, the clothing or bedding should be thrown away,” warns the US EPA.

All of which, again, casts a major safety cloud over plans by New Zealand and Australia to make these lights the preferred choice next year when incandescent lights are banned.

How could New Zealand officials have got it so wrong? When *Absolute Power* was published in April, it revealed disclosures from former MfE advisor Erin Leigh that the independence of the Ministry, and thus the integrity of its advice, had been compromised because of political interference by both Helen Clark's office and Minister David Parker. If the light bulb policy was politically driven that could explain the massive blunder by MfE in failing to take the Maine DEP report into account; the Ministry was too busy publishing what the government and the Greens wanted to hear, and did not research the safety issues around CFLs properly.

radiation from ionized mercury impacting fluorescent powder on the inside of glass tube, that technology's been around for 60 years. My own personal view is if there were any health hazard from that technology we'd have seen it long before now.”

The same question was asked of *Investigate* the following day by one of Ponting's colleagues, Leon Baard, who's a key technical consultant on the introduction of CFLs to New Zealand and Australia.

Baard says he's seen reports on the Maine study and, like Ponting, can't see why CFLs would be any less safe than commercial office lighting. “We've been living with mercury [in office lights] for 50 years, and there's no issue with it”.

At first glance it seems like a good point, but office lights are not at risk of being hit by kids playing, and office lights are usually installed and replaced by specialist lighting technicians. It's the human factor, and accidental breakages whilst changing light bulbs, that raise the stakes on the domestic front.

“I've got CFLs throughout my house,” explains Baard, “and had no problems with them. I have them in the children's bedrooms as well.”

Baard challenges the significance of the data from the Maine study, suggesting the deemed maximum exposure level of 300 nanograms per cubic metre is an arbitrary number “plucked out of thin air. They don't know what that number really means. The danger level might be ten times above that, or it might be a tenth

of it. They just don't know".

"I don't know of any study anywhere that shows mercury vapour lights were dangerous. The older office lamps had even higher concentrations, but there's no evidence anywhere that I know of, of people inhaling it and having any kind of problem. No evidence."

Nonetheless, Baard accepts that parental fears about mercury bulbs in bedrooms are not something for the industry to ignore.

"No, look, I accept parents might have a concern, and that's their right."

The answer, he explains gently, is not to cling to inefficient ordinary bulbs, but for people who are worried to look at some of the other lighting options outside of CFLs.

"There are new generation high efficiency halogens, you can get them from Bunnings today, which have been designed to replace ordinary incandescent bulbs, for \$3.69, and they last 2000 hours, and they use 40 watts but are the same as a 75 watt incandescent."

It's a point reinforced also by the Government's EnergyWise unit at EECA, which has just published a pamphlet this month reassuring householders that new generation halogen lights are being introduced for people worried about mercury contamination from CFLs.

Perhaps the most dangerous aspect to the CFL mercury issue, however, is not the instant "spike" exposure caused by a breakage, but the effect of a string of breakages over the years on the toxicity of suburban homes. Picture a low income family in South Auckland living in a Housing New Zealand home, forced to use CFLs because of the light bulb ban and because they cannot afford even more expensive halogens. Picture a breakage, then try and estimate the odds of a stressed out (or drugged up) householder following proper clean-up and disposal procedures.

Then picture a few more breakages over the years, none of them dealt with properly.

Then try and figure out how much mercury might accumulate in the carpets, floorboards and walls of such a house over a 20 year span as either a Housing NZ residence or a low grade rental property.

Then try and figure out the impact such poisoning might have on every family that moves through that house, and how many taxpayer dollars might be wasted dealing with the health or crime problems that erupt downstream because of mercury exposure.

And in case you think we're picking on South Auckland, there's a substantial risk that over the next 20 years every New Zealand home will have suffered at least one lightbulb breakage and possibly several more. When you buy a house or move into a rental, you won't know whether the home you're moving into is contaminated by mercury, unless you go to the extreme expense of getting it tested.



Your safety, and your family's safety, will rely on the ability and willingness of other ordinary New Zealanders to properly dispose of mercury laden light bulbs, and you'll never really know.

The real cost is not one light bulb breakage, but how badly affected homes will be after 20 years of amateur attempts to clean up one of the deadliest neurotoxins on the planet. A generation of children crawling on mercury-infested carpets would give new meaning to the phrase, "dumbed-down".

On the strength of these scenarios alone, there's a good case for actually banning the use of CFLs in homes, outright and immediately.

One of the arguments often cited in favour of energy-saver bulbs is that although they contain mercury, they cut the amount of mercury being emitted by power stations because of the electricity they save. This is certainly true of coal-fired stations, which do expel mercury into the air as part of the coal-burning process. It is not true of hydro, however, because hydro-stations don't generate mercury.

Regardless, it is one thing to have mercury vapour spewing out of a funnel into the ventilated open air. It is entirely different, and somewhat personal, to bring mercury back into an enclosed household in circumstances where the risks of breakage are very high. The chances of your child suffering serious mercury contamination from a coal-fired power station 200 kilometres away is almost nil. The chance of a child breaking a lightbulb during a pillow fight, or knocking a lamp over during other shenanigans is quite high. And the chances of mercury hanging around in the bedroom carpet to cause chronic exposure is extremely high.

Not that you'd know it, if this joint news release last month from the Housing Corporation⁶ and Energy Mad, the company behind Ecobulbs, is anything to go by:

"Negligible concerns about mercury level in light bulbs"

"Housing New Zealand encourages tenants to use energy-efficient light bulbs. Not only do these bulbs save tenants money on their power bills, they're better for the environment, and last almost 10 times longer than incandescent light bulbs.

"Energy-efficient light bulbs have a tiny amount of mercury in them – 1.5 (about the size of a grain of salt) to 5 milligrams. This level of mercury is so low it's not deemed a 'hazardous waste' by landfill operators.

"In fact, most dental fillings have up to 100 times the mercury contained in Ecobulbs, the energy-efficient light bulb brand that Housing New Zealand recommends.

"Also, mercury in Ecobulbs is contained in an 'amalgam', so even if the bulb breaks the mercury is likely to remain intact."

As the Maine scientific study shows, "yeah, right."

Four months after the release of the Maine study revealing that floors should not be swept or vacuumed, and that plastic bags were useless to contain the mercury waste, both Ecobulb and the Housing Corporation were still offering out of date disposal advice:

"Energy Mad, suppliers of Ecobulbs, recommend the following disposal options:

"If the bulb breaks – Air the house for about 10-15 minutes. Broken bulbs fragments should then be swept into a bag (don't vacuum) and taken to your local refuse station for recycling. Be sure to wear gloves to avoid being cut."

Because of the Maine study, we now know that following the guidelines to the letter won't clean the mercury out of your carpet. It might look clean, but the experiments revealed looks were dangerously deceiving. We also know that being cut by a piece of bulb is probably the least of your worries.

The argument from lighting manufacturers and the NZ and Australian governments that 5mg of mercury is "negligible" doesn't hold water either. Five milligrams is about the size of a fullstop. However, the EPA limit for human exposure to mercury in the atmosphere is only 300 nanograms. To put that in context, it

may help to remember that 5mg is actually *five million nanograms* of mercury. A 1.5mg bulb is still 1,500,000 nanograms, when the recommended maximum level for human exposure is way down on just 300 nanograms.

So the chances of inhaling something toxic if a light breaks are actually extremely high, and inhalation is actually the easiest way for a human to be poisoned by elemental mercury.

The Maine discovery of dangerous levels of elemental mercury vapour being emitted from one broken light bulb also raises issues for transport and retail workers in New Zealand. A truck that crashes whilst carrying a load of CFL bulbs could release extremely hazardous levels of mercury vapour into the traffic, putting motorists, pedestrians and emergency service workers at risk.

Likewise, a supermarket worker who drops a box of CFL bulbs could release enough mercury to contaminate the supermarket, staff and customers, and food.

Bearing that in mind, we asked retailers whether they'd had any instructions from government agencies on how to handle CFLs and how and when to report a hazardous incident. We were unable to find anyone who'd been given any such advice.

Given that CFLs have been on the market in New Zealand for years, and are highly likely to have been smashed in stores at times, this raises major safety concerns.

In our efforts to nail down the Government agency responsible for this, *Investigate* first rang the Labour Department – once the home of Dangerous Goods Inspectors and now OSH (Occupational Safety & Health). Surely, if a supermarket staffer dropped a CFL, OSH would need to be advised.

"No, it's not us," exclaimed the Labour Department. Dangerous Goods are handled by ERMA (Environmental Risk Management Authority), and electrical safety issues are handled by Energy Safe.

We rang Energy Safe.

"No, our responsibility only kicks in when an appliance is plugged in," explained a senior executive. "CFL bulbs damaged in transit or storage, that's not our role. You could try ERMA."

So we did.

ERMA, however, likewise deny drafting any rules for transporting, storage or handling of CFLs, even though mercury is listed on the ERMA website as a hazardous substance.

"No, the CFL bulbs are not under our jurisdiction," said a spokesman. "They are not listed under the Hazardous Substances and Noxious Organisms Act."

Quite how light bulbs containing mercury avoided being listed under that Act is a mystery worthy of further exploration.

Energy saving light bulbs have been on the market for years. But throughout that time, no cabinet minister has ever queried how the mercury lights are handled, and no government safety agency has addressed the issue. The question is, how many workers, customers and householders have been exposed to dangerous doses of mercury vapour because of a failure by the Government





“Because of the Maine study, we now know that following the guidelines to the letter won’t clean the mercury out of your carpet. It might look clean, but the experiments revealed looks were dangerously deceiving”

THE WOMAN WHO CHANGED THE WORLD

American mother Brandy Bridges dropped a light bulb, and the scientific ripples from her experience have gone right around the world, sparking a discovery that CFL bulbs are not safe if they're broken or cracked. **IAN WISHART** interviewed Bridges from her home in Prospect, Maine, about the day she dropped the bulb and made a phone call to the Department of Environmental Protection (DEP)

BRANDY: First they recommended I have it professionally cleaned, because that was their protocol, and then when I went to the papers with that information they completely changed their protocol to say that people could clean it themselves with just paper and duct tape.

I obviously didn't do that. I sealed the room with plastic and quarantined the room – my daughter wasn't allowed in there because of the mercury in the room. And then the DEP offered to come back out and remove the carpet for me. They removed the carpet, re-tested everything and sealed everything in containers and disposed of it as hazardous waste.

INVESTIGATE: Did they replace the carpet?

BRANDY: Oh gosh no, they left a huge mess. They cut the carpet only out of the middle of the floor, so there was still carpet under her bed and her couch, her dresser and her entertainment centre. They just cut out the middle and left a big mess.

I stripped everything. I actually threw away all the blankets. We aired out teddy bears outside, washed them and tried everything we could that we got that stuff, and we threw most everything away because of the area that was contaminated – there were [mercury] readings from the top of the stairs all the way to her bed.

INVESTIGATE: They got mercury readings all that way?

BRANDY: Yep, from one tiny – it was the smallest CFL you can actually buy. It was the tiniest bulb.

INVESTIGATE: What size hole did they leave in the carpet?

BRANDY: Probably eight by ten.

INVESTIGATE: Inches?

BRANDY: No, eight by ten feet.

INVESTIGATE: Eight by ten feet??

BRANDY: Yeah, it was the entire centre of her room, all except for where her bed covered, her dresser, entertainment centre and couch.

INVESTIGATE: Did they make any comment about the readings that they found at the time?

BRANDY: Well, it was about three months after the bulb actually broke, and we had plastic down on the floor and had ventilated with windows open up there, and had moved my daughter to a different room in the house, and when almost three months later when they came back and removed the carpet, the bag where they had placed the carpet into still had readings higher than the state's danger level.

INVESTIGATE: So I take it you're not that fond of the CFL bulbs now?

BRANDY: Gosh no. We went back through the entire house and took every single bulb out and replaced them with Thomas Edison's great invention (the incandescent bulb).

INVESTIGATE: What's your reaction to the news that Congress has passed a recommendation that these things become compulsory?

BRANDY: I think they have a lot invested, a lot of advertising, marketing, a lot of massively huge companies backing them, G.E. being one. There's a lot of big name companies out there, they've built a business and a market on these bulbs. That's how they're making their money. With the go-Green craze and everything, it's really good marketing right now. They're offering people savings on their lighting bill when oil prices are so high.

They're saying it actually helps the environment. Just in Maine, there's over one million CFLs sold in less than a year. That's one million CFLs (five kilograms of mercury) going into the landfills in three to five years, whenever they all burn out. So every year, now that they've been on the market for so long, there's going to be over a million bulbs going into the landfills.

We don't even have a place to recycle them. People don't even understand that it's toxic, it's deadly, it can cause problems from reproductive harm to cancer, lots of bad things. That's why we got rid of mercury thermometers.

We get rid of one mercury thermometer per household and put 50 CFLs in there, and if one tiny CFL can hold 1.9 million nanograms of mercury, when the state says it's dangerous to have anything over 300 nanograms in your home. And this little bulb was measured emitting 2,000 nanograms, that's telling you something.

They say it reduces emissions, and that's been their big selling point here in Maine that the CFLs reduce emissions from power plants, well that's power plants that burn coal, but here in Maine we use hydro-electricity. We have so much water! They use water dams, they don't burn coal like they do down south. So really it's not helping us at all, it's more hurting our environment up here than helping it. [Editor's note: NZ coal generation normally accounts for about 8% of total electricity]

INVESTIGATE: What sort of response have you had from people? I mean, really, you became the canary down the mineshaft for all of America on this because even the EPA is modifying its guidelines based on your experience.

BRANDY: Yeah, there was a lot of controversy about it. Some people thought it was an over-reaction, and some people thought it was a valid point, but I just believe what the science tells me and it tells me in every piece of literature and every statistic that I've read that mercury is not a good thing. The mercury contained in the bulbs is completely different from the mercury our parents used to experiment with at school. That was a liquid form of mercury that has to be ingested before it really harms you, but this powder mercury is inhaled. It goes into the air and vapourises like a gas, and you inhale it and then it's absorbed into your lungs. It's an accumulative metal, it just keeps building and building in your bloodstream, so the more you are exposed to it the sicker you become.

INVESTIGATE: I guess also the danger is that it's very easy to



break them. Give a household 20 years to break a few and not clean them up properly, and suddenly you've got a major toxic problem.

BRANDY: It's becoming a really big problem and it's more dangerous than people think it is. The God's honest truth is, when I called Poison Control here to find out how to clean it up, they had absolutely no information at all on light bulbs. They didn't even have the information that there was mercury in the bulbs – I actually got that information from Home Depot!

I knew not to vacuum it, I remembered from a shop class, not to vacuum fluorescent bulbs because of the powders and whatever, you are supposed to clean it with a damp sponge, but this was on a rug so it wasn't even possible.

INVESTIGATE: I see the Maine authorities have recommended they shouldn't be used in children's rooms or over carpeted areas.

BRANDY: That was one of my first comments to the newspapers, it should be a choice, it should not be mandated by government that you have to put a chemical in your child's room. Nurseries, daycares, places where bulbs could go flying.

They're not as eco-friendly as we'd like to think. Just the fact that they're being shipped in trucks and who knows how many cases get dropped? You're in your local hardware store, and they're broken on the floor, and you're walking by unknowing that there's mercury there, that people are just walking by and breathing in, and a lot of people don't have a clue.

Our Maine CDC (Centres for Disease Control) – Doctor Andrew Smith is the Maine CDC and also the state toxicologist – when I called him to speak to him about this matter he didn't even know that the bulbs contained mercury. Then he started asking questions like, 'Do some bulbs contain more mercury than others? Did you just get a weird bulb?'. I said, 'no, I really don't think so!' I had a really small bulb so if it goes by size and brightness I'm assuming the larger bulbs would have more mercury.

to ensure safety standards were designed and adhered to?

Executives at one of the country's largest retail chains were stunned when we told them the results of the Maine study, and the implications for retailers if bulbs break in shopping aisles or storage areas.

"No one has told us anything, but now that you've put us on notice we are certainly going to have to address this."

There is one piece of good news. As a result of *Investigate's* inquiries, the Ministry for the Environment has now obtained a copy of the Maine report and is promising to update its information bulletin on CFL safety. The Ministry has also acknowledged as we went to press the existence of a second study⁷, published only this month, that confirms the Maine findings: CFLs release hazardous amounts of mercury into the air when they break.

FIRE RISK

Just a few weeks ago, on April 30 this year, US truck driver Rick Jenkins found out the hard way about the safety limitations of CFL bulbs. Last year, he kitted out the family home with the latest generation of high performance CFL lights, in order to save money via their longer lifespan.

Now, he's US\$165,000 worse off after one of those CFLs caught fire and burnt his house to the ground in the state of Maryland.⁸ Jenkins, his wife Angie and six year old daughter Haley escaped with their lives, but that was all. The CFL had been installed in a dimmer. But they don't work in dimmers, and the light eventually caught fire.

Another who suffered a similar failure was Canadian Charmain Miles of Toronto, who smelt smoke coming from the second storey of her home, and traced it to a smouldering CFL bulb.

"I was horrified," she told a Toronto TV station. "I went through every place upstairs and took out every bulb."

In Miles' case, reported *WorldNetDaily*, the CFL was in a track-lighting fixture. There was no warning on the box or the bulb about track-lighting, but it turned out the CFLs could not be used in track, recessed or dimmer fixtures.

Now, even in ordinary light fittings, increasing numbers of people have discovered their CFL energy-saver bulbs smouldering or on fire.

But according to the experts, get used to it. That's exactly what CFLs are supposed to do when they reach the end of their tether, burn out in a pall of acrid plastic smoke and carcinogenic fumes.

"Ontario's Electrical Safety Authority will issue a warning later this week to notify users of the unexpected way compact fluorescent light bulbs expire at the end of their long lifespan," reported Canada's CBC TV network last year.⁹

"Ted Olechna, a provincial code engineer with the Mississauga-based authority, said he plans to post the warning on its website. The bulbs come to an end by charring around the base, producing smoke and emitting a bad smell.

"That has scared some homeowners into calling fire departments, he said. But there have been no reports of fires resulting from fluorescent bulbs in Ontario, Olechna said.

"The upcoming advisory will explain that this is the normal way for these energy-efficient bulbs, which can last up to 10,000 hours, to die."

The problem is, as the photos show, that not only is the smoke dangerous to householders, but if the glass tube cracks in the heat mercury vapour will be released as well.

One Canadian technician, Doug Hembruff, has dedicated a



“Jenkins, his wife Angie and six year old daughter Haley escaped with their lives, but that was all. The CFL had been installed in a dimmer. But they don’t work in dimmers, and the light eventually caught fire

blogsite¹⁰ to documenting issues with some of the CFL bulbs. It’s full of stories from customers like this one:

“There was no actual flame, but it filled the globe (sealed light fixture) with very acrid smoke and then the smoke began to fill the hall. We were moving about in the hall at that particular moment and discovered the problem almost immediately. Whether the bulb will actually flame if left in a socket I don’t know. It was powerful hot in that globe when I took it out and still actively belching smoke...”

Or this one:

“To date three bulbs have failed and the last one overheated and burnt the plastic housing filling my bedroom with acrid smoke. The bulb did not shut down and continued to smoke until I shut

down power. The model number of the bulbs failing is EDXO-23. What really spooked me about this issue was this bulb was directly over my bed. When I saw the plastic beginning to melt and start to bubble, I turned off the power. I don’t know if the bulb would have begun dripping burning plastic or not, but if it had then it would have fallen onto the bed blankets producing a possible fire hazard. Notice the bulb got hot enough to crack the glass near the melted area.”

Or this one:

“Thanks for the article. Just wanted to add that a Luminus 23W 2923-Lo2 just started flickering and belching acrid smoke at me in the last half hour. Examining the bulb closer, it was glowing orange around the base and sizzling. I unplugged it before a



fire could really take hold. The glass was melted and black goo emerged from the base. This CFL was purchased last year...and I have about 8 of these in the house in various places. Now I am nervous. I think the manufacturer is liable for selling a dangerous household item here. I am a professional engineer and appreciate the effort you have made here to increase public awareness of an obviously serious consumer problem. I am shocked (no pun intended), that this device has CSA approval."

Even well known brands like G.E. are not immune:

"My lamp burned out with a loud fizzle (heard in the next room with the TV news turned on, and I have significant hearing loss) and terrible odor of burning plastic. It looks much like the photo with your article--discolored and charred around the base of one of the sets (of three) of the glass units, and the bottom third of the glass unit is darkened on the inside. There was only a bit little smoke. I figured out what had happened and immediately turned off the fixture. The bulb was very hot, but I did not want to damage the fixture, so I used kitchen hot pads to gingerly remove the bulb from the fixture. I developed a severe headache about 10 minutes after the incident and realized I needed to turn on vent fans to clear the air. I hope there will be no further repercussions from the incident. I have no idea if this unit has an "End of Life" sensor, since I don't know what what to look for on the lamp. The lamp was used in a wall-mounted hall light fixture with an open metal sconce than is angled down towards the floor."

The problem seems to be that 90% of the world's CFLs, including big name brands, are ultimately manufactured in China, where quality control has been somewhat of an issue across the board in recent years.

Ideally, CFLs should have some kind of sensor that detects overheating and blows an internal fuse before the lamp starts to melt or smoulder. Many, however, do not. Burnouts have been reported to the Energy Safety Service in Wellington already, along with reports of acrid smoke.

REDUCED LIFESPANS

One of the biggest selling points for energy-saver bulbs has been the claim that they last far longer than incandescent bulbs. The

average incandescent will last about a year (1,100 hours, being 365 days @ 3 hours a night). On the other hand, CFLs are claimed to last at least 6,000 hours, and some are claimed to last up to 12,000 hours (11 years).

This, claim manufacturers and the NZ Government, well and truly offsets higher cost of buying the bulbs. But a briefing paper prepared for the Australian government¹¹ (New Zealand and Australia are implementing the switch to CFLs simultaneously with the same standards), reveals the Aussies are pitching a lifespan standard of only 2,000 hours. That's because most if not all the CFL bulbs are manufactured in China, where production standards vary considerably and what's on the box doesn't necessarily equate to real performance.

Indeed, if you Google the words "CFL" and "lifespan", you'll find the internet abuzz with dissatisfied customers.

"My bedroom has outlets for 8 recessed 100W lamps across the ceiling," writes one complainant to Yahoo Answers. "As they started burning out a few years ago, I started replacing the traditional incandescent lamps with CFLs. Now I've replaced two of the three new CFLs within two years. I still have three original incandescent lamps that are several years older that are still working on the same circuit.

"Bottom line – are CFLs just another gimmick to sell a product many times more expensive than the commodity product using claims that are patently untrue? Does anyone have real figures on how long CFLs last, how much energy they really consume, and whether it makes economic sense to anyone other than the seller? Has there been any legal action to get more truth into the advertising?"

One of the biggest boosters on the New Zealand market is Ecobulb, which claims on its website that its CFLs can "last 10-15 times longer than standard incandescent or halogen lamps". That's a claimed lifespan of up to 15 years as far as the consumer is concerned. But Ecobulb hasn't put its money where its mouth is, and offers only a two year warranty.

Philips NZ, on the other hand, is offering a warranty of four years based on 4.5 hours use per day, meaning they guarantee their lamps to burn at least 6,500 hours or your money back.

Osram NZ was unavailable at press time, but Osram's global website claims a lifespan of up to ten years and a warranty of five years. An Osram Australia spokesman told *Investigate* that the company would honour the pledges on its global website, provided it was for the same basic lightbulb model.

Lighting Direct sells its own imported brand of CFL, Envirolux, with a claimed lifespan of 8,000 hours, or seven years. However, it is only prepared to offer a 12 month warranty.

Lighting Plus stores sell the G.E. lights, made by the US giant General Electric. Surprisingly, while the G.E. lamps in the US carry a five year consumer warranty, G.E. Australasia is refusing to offer any warranty at all on the lights sold downunder, despite the claims on the box of an 8,000 hour life (seven years).

Investigate asked the Ministry of Consumer Affairs whether the public would have any protection under the Consumer Guarantees Act if a CFL bulb blew outside of the stated warranty period. The Ministry told us:

"Manufacturers have obligations under the CGA, independent of any warranty they may choose to give. Of relevance to your enquiry, is the guarantee under the CGA that goods must be of acceptable quality, meaning they must be:

- fit for purpose
- acceptable in appearance and finish
- free from minor defects
- safe
- durable.

“The test is what a reasonable person would consider acceptable quality, given the nature of the good, the price paid, any representations made on or about the good and all other relevant circumstances.

“Manufacturers cannot contract out of the above quality guarantee – durability under the CGA is not affected, or limited by any warranty period a manufacturer specifies.”

In other words, keep the receipt if you buy a CFL, put it in a special place and be ready to wave it if you don't get at least five years' normal usage out of your bulb.

Part of the problem, it turns out, is that the “lifespan” of a CFL bulb has been artificially measured. International standards currently require a manufacturer to run the bulb in three hour cycles in the lab, only switching it on at the beginning and off at the end. In other words, the bulb burns for three hours straight with no interference.

In the real world, things are very different. Many householders, particularly in these energy-conscious times, switch on and off lights frequently as they enter and leave rooms. Many modern CFLs are not built to withstand short switching cycles (although Ecobulb claims theirs are). One recent study shows the lifespan of

bought them from & then call the EPA. Pay back is hell!”

Another key to the short lifespans of many CFLs is that, despite what they promise on the box, they are not ideal for all light fittings, including some overhead lights.

Unlike a normal bulb, which screws into the ceiling and hangs down, CFL lights actually work best (and are lab tested this way) pointing up, not down. That's because the “ballast”, the unit at the base of the light, contains complex electronic components that normal light bulbs don't have. When CFLs hang down, particularly the 100 watt equivalents or greater, the heat generated in the bulb travels back up to the base and slowly fries the electronics, bringing on early failure and/or physical burnout.

Unfortunately for homeowners, most basic light fittings involve a lamp hanging from the ceiling, rather than based on the floor pointing up. Recessed ceiling lights, such as those common in many newer kiwi homes, may focus even more heat on the base of the CFLs. As a result, there's no guarantee householders will get anywhere near five to ten years' life out of a CFL in the home, which may be why manufacturers are reluctant to back up the hype with a warranty.

“It has been my experience that CFLs fail prematurely due to heat build-up,” wrote one US blogger. “I noticed that I had a high failure rate in certain fixtures in my home, but not others. Generally speaking, I had a high failure rate in fixtures that place the CFL's electronics above the fluorescent tube, and in those that trap heat inside. After correcting my “fixture” issue, my CFLs tend not to burn out.”

“Ideally, CFLs should have some kind of sensor that detects overheating and blows an internal fuse before the lamp starts to melt or smoulder. Many, however, do not”

a CFL can be shortened by a massive 85% under normal domestic household use conditions. In other words, if the lab lifespan was 2,000 hours, you might get only 300 hours (four months) out of that CFL if you were unlucky. A 6,000 hour bulb (five years) would give you only 12 months or so of light before dying unceremoniously.

The Australian Government, which is jointly introducing CFLs with NZ, acknowledges the problem.

“Frequent switching on and off will shorten the life of most CFLs. However, as an adjunct to the incandescent phase-out initiative, the Australian Government will introduce MEPS for CFLs that will include a basic standard for switching. This standard requires over 1000 switching cycles per 6000 hours of lamp life.”

Before you get excited, however, that's a standard that only allows one switching cycle (on/off) during a six hour stretch.

Back on Yahoo Answers, one respondent also targeted the apparently short lifespan of CFLs:

“I'm not sure about how long CFL lifespan is, either, but I have observed the same phenomenon at my house. I have noticed that the bulbs which are in a protected fixture (such as an outdoor lamp) last far longer than ones on my ceiling. All my ceiling fixtures have one CFL and one incandescent bulb (so the fixture lights quickly), and invariably the CFL burns out faster.”

“I've had the same experience,” remarked another, “some whack out in less than a year & others keep going.... take the burnt out ones & break them in the parking lot of the store at which you

That's great for countries where CFL use is not compulsory, and householders can pick and choose the best locations for CFLs. But where ordinary bulbs are being banned, and CFLs are not suitable replacements, homeowners have a massive problem.

Nor do the CFLs have the record for longevity. The oldest working incandescent light bulb in the world is still burning in a Los Angeles firestation. It was put into service in 1901, making it 107 years old this year. The light burns continuously, which lessens the stresses of switching. Even so, the record books disclose another incandescent bulb in the fire station at Magnum, Oklahoma, which has been burning for 82 years under normal use (it gets switched on and off).

CFL technology, on the other hand, shows the fluorescents start to lose power. Under the new standards being proposed for New Zealand lights next year, CFL bulbs will be required to still burn at 80% of their original brilliance once they reach 40% of their claimed lifespan. Overseas tests have revealed however that the CFLs can quite quickly slide after that, dropping to just 66% of their original brightness once they're past the halfway mark.

So even if the CFL light actually lasts as long as the promise on the packet, by the time it reaches the end it is unlikely to be shedding anywhere near the amount of light it did when new. Homeowners who need working lights in their houses may still have to buy new CFLs long before the claimed end of life, simply to maintain brightness levels.

While the NZ Government-approved “Ecobulb” admits on its

NZ FORUM ON THE FAMILY

- Inspire
- Educate
- Network



Election '08 Family Policies



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NATIONAL



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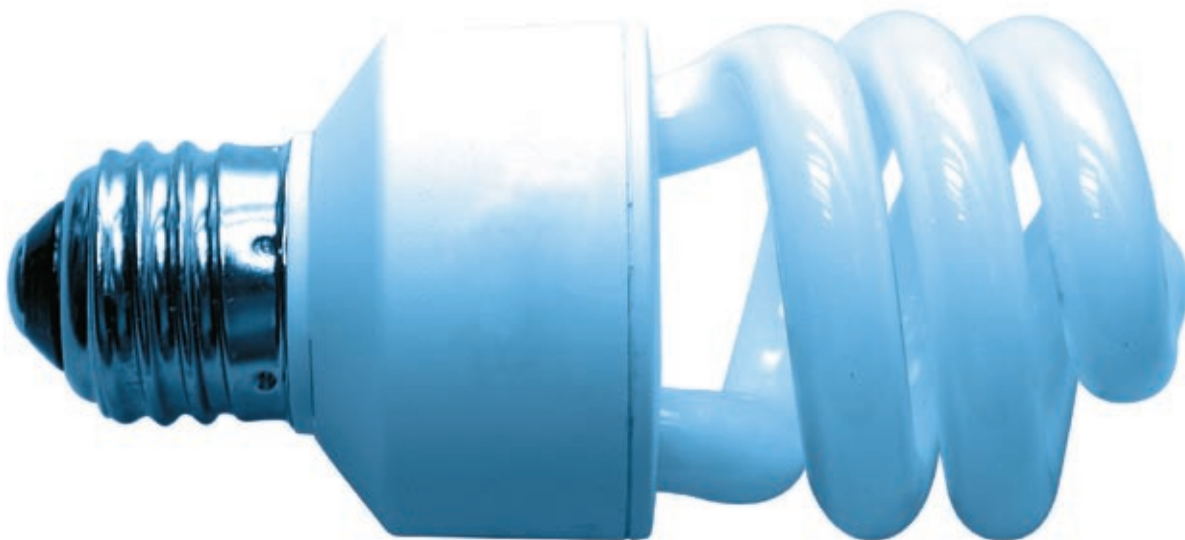


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WHAT TO DO IF IT BREAKS?

THE LATEST ADVICE FROM CALIFORNIA'S DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Fluorescent lights are energy efficient and help reduce greenhouse gases that contribute to global climate change. These lights are able to accomplish this because they contain small amounts of mercury.

Mercury is a natural element that has many uses. However, mercury is a powerful neurotoxin and causes a variety of adverse health effects due to exposure. Those who are at most risk from mercury exposure are pregnant women and developing children.

The leading consensus from environmental organizations and government is that although fluorescents should be handled with care and managed properly to avoid breakage, they are still recommended for business and residential use due to their many benefits.

That being said, people should handle these products with care and common sense – much like you would when driving to avoid crashing your car. By taking simple steps to prevent breaking fluorescent lights, consumers can avoid exposure to mercury. Due to the possibility of mercury vapor being retained in carpets, you may want to consider using and handling fluorescent lights only in areas above hard flooring as well as areas with lamps that are not easily knocked over by children or animals.

The following guidelines are based on recommendations from the U.S. EPA and the recent study conducted by the state of Maine for cleaning up after a CFL or fluorescent tube breaks. Please note that in California, these lights are not allowed in the trash and must be managed as Universal Wastes. It should also be mentioned that if you break a CFL that no longer works or has been used for a while, as opposed to a new CFL, the amount of mercury vapor released during a break is likely to be significantly less. This is because much of the mercury will be bound to the glass rather than released as vapor.

When a fluorescent light breaks please refer to the following guidelines:

- Open all doors and windows to ventilate the area for at least 15 minutes.

- Turn off your AC/Fan/Heater so as not to circulate any mercury vapor
- Young children and pregnant women should leave the area during cleanup.
- Wear appropriate personal protective equipment, such as a dust mask and gloves to keep bulb dust and glass from being inhaled or contacting your skin.
- Carefully remove the larger pieces and place them in a secure closed container.
- Next, begin collecting the smaller pieces and dust. It is recommended that you use two stiff pieces of paper such as index cards or one of the many commercial mercury spill kits available.
- Put all material into a sealed container. Pat the area with the sticky side of duct, packing or masking tape. Wipe the area with a damp cloth.
- Put all waste and materials used to clean up the bulb in a secure closed container and label it "Universal Waste – broken lamp".
- Take the container for recycling to the household hazardous waste facility (HHW) nearest you.
- If the bulb breaks on carpet, the State of Maine's report suggests removing the area of carpet that has been contaminated as a precaution. If this is not feasible, it is recommended that you ventilate the area for several hours as well as during the process of vacuuming because vacuuming can circulate the vapor. If you vacuum, make sure to dispose of the bag along with the broken CFL at your local HHW. You should also ventilate the room during the next few times you vacuum the area.
- To read the entire study that the state of Maine did on handling broken CFLs visit <http://maine.gov/dep/rwm/homeowner/cflreport.htm>

(SOURCE: California Department of Toxic Substances Control, July 2008 http://www.dtsc.ca.gov/HazardousWaste/UniversalWaste/Fluorescent_Lights.cfm)

website that “the light of an Ecobulb does decrease over its life,” the company tries to assert that “this rate of decrease is less than an ordinary bulb.”

Unless the Chinese manufactured Ecobulbs have overcome the technical issues plaguing CFLs generally, the bold claim is not true, as EECA consultant David Cogan’s report notes, “the degradation of light output [in an ordinary bulb] is not so severe as for a CFL”.

Then there’s the cost associated with a short lifespan.

Figures from a Dutch study in 2001 suggest a CFL light bulb requires 1.7kW of energy to manufacture, compared with only 0.3kW to make an ordinary incandescent bulb. So a CFL is already nearly six times more expensive in terms of energy consumption to make. Nor did the study take account of the energy and carbon footprint generated by mining to obtain the rare earth phosphors necessary for fluorescent tubes. And what about the cost of recycling the CFL lights?

Like New Zealand and Australia, the Labour Government in Britain is also pushing to ban ordinary light bulbs in favour of CFLs. Recognising the toxic waste problem, Britain is examining recycling schemes. The cost, however, is prohibitive. One environmental agency report suggests it could cost US\$1,300 to recycle one wheelie-bin full of CFL light bulbs. It’s a cost that will ultimately fall on ratepayers.¹²

POWER DISRUPTIONS

As if all of the above were not enough, briefing papers prepared for the New Zealand Government reveal a massive technical hitch that does not appear to have an easy solution. The problem centres around what is known as “harmonic distortion”. Because of the way fluorescent lights operate – igniting a gas (rather than heating up a wire as electricity passes through as conventional bulbs do) – the new lamps place an uneven load on the electricity grid, setting up harmonic distortions in the power lines and power stations.

New Zealand’s already creaking national grid is designed to tolerate total harmonic distortions (THD) of no more than 5%, but a 2006 study by Parsons Brinckerhoff Associates for the Electricity Commission warns that the widespread introduction of CFL lights could collapse the grid, causing power cuts and equipment failures.

The cheapest CFLs on the NZ market have what is called a “nominal power factor” (NPF) rating. They certainly deliver energy savings to consumers, and they can even outperform more expensive bulbs in other areas. But they’re a power company’s nightmare.

“The high harmonic currents inherent in nominal power factor bulbs pose a major primary risk to power distribution companies and system users in terms of a negative effect on power quality,” PB Associates have advised the Electricity Commission.

“A New Zealand study,” they continue, “aimed to estimate how many CFLs per household would cause the THD limit of 5% to be reached. The study results indicated that the THD...reached 5% at a load of...14 lamps per household.”

In other words, making CFLs the mainstay in every house could certainly push New Zealand’s national grid to its limits. PB Associates cited a 1992 study by Lincoln University which was looking to install 2,500 CFL bulbs on campus, and wanted to measure the harmonic impact.

“A number much less than the proposed number of CFLs would



push the THD well above the 5% limit prescribed in the NZ Standard.”

The report detailed the case of a road lighting scheme using one megawatt of total lighting power. Despite all the fluorescent lamps meeting European harmonic standards, “the harmonic currents were so high that the lamps could only be run at 70% full power without overheating the transformer.”

“Harmonics can cause a variety of network problems – transformer and cable overheating (hence lowering lifespan), motor overheating, premature ageing of capacitors, interference with telecoms systems, possible disturbances in ripple control systems (hot water).”

Yes, the prospect of cold showers once all households are converted to CFLs next year is being taken as a risk factor by electricity authorities, partly because NZ’s ripple control technology is older and more likely to suffer stress from harmonic interference from lightbulbs.

“Power quality problems caused by CFLs dispersed throughout residences will be more difficult to identify and tackle,” warns the PB Associates study, “and will raise a debate about who will pay for the expensive compensation equipment.”

There is a partial solution. Although nominal power factor bulbs cause the most harmonic distortion, high power factor (HPF) bulbs cause less, but they are more expensive for consumers. PB Associates is recommending HPF as the emerging standard for New Zealand, but admits “There are concerns that the HPF bulb has a higher probability of failure than the NPF bulb due to the increased number of electronic components (in the ballast at the base) exposed to heating effects.”

Furthermore, the report to the government warns that those heating effects on HPF lamp ballasts may substantially degrade the power factor anyway, thereby rapidly increasing harmonic

distortion in the power grid as the bulbs age.

"No conclusive evidence yet exists in the public domain that clearly illustrates the ageing effects of different types of electronic ballasts," warns the report.

In other words, the political decision to make CFLs compulsory from next year has been taken despite scientists not yet having enough evidence to assess the likely risks to households and the power grid.

The PB Associates report acknowledges that even with the low penetration of CFLs so far, "there have been some documented cases of CFL use and related power quality implications." The study notes in passing that "over the years, the Benmore transformers have been unreliable and problematic," but adds that engineers have so far "not proven" what this has been caused by.

In the US, they're already starting to notice the impact of kitting out entire homes with CFLs. One blogger last December¹³ recounted how a workmate had a problem with the gas heating system at home:

"The first thing the repair man asked him was if he had recently replaced any bulbs with a CFL bulb. He told him that in the last week since it had gotten really cold he had received several calls that people's furnaces were not working. He had found in 6 cases that there was a new CFL bulb installed in the home that was the problem."

According to another briefing paper prepared for the New Zealand Government, interference with other appliances is a common side effect of CFL bulbs, and the more bulbs you have, the greater the risk.

"CFLs with electronic ballasts...also interfere with wireless devices and, in New Zealand, ripple control systems (hot water). Harmonics may also interfere with or even damage other equipment, especially electronic appliances," consultant David Cogan warned in his paper.¹⁴

"There have been cases of a CFL mimicking an infra-red remote control and causing unwanted changes to other appliances, such as changing channels on a television. This is probably related to poor harmonic performance, but is still under investigation."

The interference can run from crashing wireless networks, to increased static noise on radios, televisions and the like. In the US, engineers refer to the output of CFLs as "dirty electricity".

The purpose of the briefing papers has been to identify likely trouble spots and see if they can be worked through. While the standards eventually imposed early next year are likely to be strong, there's no guarantee they'll prevent some of these problems emerging.

There are also grumblings within the industry, with some expressing the belief that Energy Mad, the company behind Ecobulbs, managed to get the front-running on the introduction of CFLs because one of its top executives, the coincidentally-named Peter Watt, had previously worked for the Government helping to draw up the standards and guidelines for the Electricity Commission on CFLs.

In fact, the documents show that while Watt worked for the Electricity Commission he was a key figure in the tender process¹⁵ that ultimately ended with Energy Mad being named as preferred supplier of CFLs for next year's compulsory roll out. For the sake of avoiding doubt, *Investigate* is not suggesting Watt has misused his position in any way, but the magazine does believe that it isn't a good look for a government official administering a tender pro-

cess to suddenly end up working for the company that wins the tender. Energy Mad, whose executive team also includes a Green Party candidate at the last election, has made large amounts of money by getting the Electricity Commission and other government agencies to subsidise the sale of a million of their CFL bulbs to the public.

Having produced a bulb that just happens to almost exactly fit the standards the Government has laid out so far, Energy Mad also boasts on its website about getting a 15 month head start on its rivals:

"Other light bulb manufacturers have attempted to develop high power factor CFLs...it is likely that they will eventually produce viable high power factor CFLs to compete against the Ecobulb™. However, the Ecobulb™ then has a 15 month first mover advantage."

Late as this issue was going to press, the lighting industry, in the form of Lighting Council CEO Richard Ponting, questioned the significance of the mercury readouts taken by the Maine scientists:

"We note from the detailed study undertaken in Maine of Mercury Vapour densities, that the results are measured in nanograms/m³. All the internationally accepted guides to hand set the advisory thresholds in micrograms/m³, and you will appreciate the large factors involved between these two scales. The concentration values quoted in the study are therefore well below those widely regarded as a health hazard. In fact the report indicates that even the authors themselves are not sure if the values obtained actually do represent health hazards."

"The guides referred to above include advisories from NEWMOA, an organisation of which the State of Maine is a member, the USEPA and the World Health Organisation. We are therefore confident that based on literature available at present, the operation of, or even the very occasional breakage of, a CFL will not expose the user to undue levels of mercury provided sensible precautions are taken with its disposal."

Unfortunately, the Lighting Council's counter-argument was based on a serious misunderstanding of the Maine study figures. Firstly, we explained to them, ng/m³ is the usual measurement system for elemental mercury in the air. Micrograms are more commonly used for blood and urine tests.

It actually doesn't matter, however, as both are units of measurement. You will find the EPA RfC limit for daily ongoing exposure to mercury is 0.3 micrograms per m³ (using the Lighting Council's preferred reference framework), which is expressed by the EPA as 300 nanograms/m³. The figures mean the same in terms of the real quantity involved.

The 5mg (milligrams) of mercury in a bulb is 5 *million* nanograms, or expressed in another way: five thousand micrograms. More than enough to do damage.

Investigate referred the Lighting Council to a recent report by the US Centers for Disease Control (CDC)¹⁶, which – contrary to Ponting's belief – measures hazard levels in nanograms as well.

The report details how a Kentucky High School became the centre of a HazChem alert after a student was found playing with mercury in the school cafeteria. The CDC reported mercury vapour samples in the air similar to those caused by a broken CFL light bulb, and as a result the school was closed while toxic waste teams were brought in to clean it up.

US EPA rules specify that if a non-residential site has an ambient mercury vapour level exceeding 3000 ng/m³ (or three micrograms per m³), then the site is deemed "unrecoverable" according to the



“The political decision to make CFLs compulsory from next year has been taken despite scientists not yet having enough evidence to assess the likely risks to households and the power grid

CDC report and shut down permanently. The limit for homes is even lower: 1000 ng/m³, because of the higher lengths of time people spend in a home. Readers will recall that three months after Brandy Bridges house was cleaned, it was still recording ambient mercury of nearly 2,000 ng/m³ – which is why the carpet had to be removed and destroyed.

The CDC report says blood and urine samples were collected from anyone “who spent one hour or more in rooms or vehicles during periods in which those places were known to be contaminated.”

And how contaminated were the rooms and vehicles?

“The school cafeteria contained mercury levels ranging from 5,280 ng/m³ to 36,600 ng/m³. The school was closed by the school superintendent to limit the potential for exposure of children and to facilitate cleaning of the cafeteria. After 2 days of cleanup, heating, and venting, EPA deemed the school safe for students to return.

“Approximately 15 school buses were also tested and/or cleaned. The family’s mobile home and possessions were deemed unrecoverable (ambient mercury was >50,000 ng/m³ at outset of investigation and later reduced to 11,550 ng/m³) and were removed and destroyed. The family van (14,950 ng/m³ reduced to 1,285 ng/m³)

and an additional vehicle (>50,000 ng/m³ reduced to 174 ng/m³) were eventually cleaned and returned to the family. However, a third vehicle (41,275 ng/m³ reduced to 36,610 ng/m³), belonging to the family of a friend of the student, was determined unrecoverable and removed by EPA.”

Now compare those figures with the up to 100,000 ng/m³ of mercury leaking from one broken CFL bulb in a bedroom, and ask yourself the obvious question: is the lighting industry in denial?

If it is good enough for a school cafeteria to get the full EPA HazChem emergency response team because of contamination measuring 36,000 ng/m³, why is an even higher contamination of a private house treated with a shrug of the shoulders by NZ health officials?

And what of the fate of the student who’d been bringing the mercury to the Kentucky school, and his family? The CDC report contains more damning information.

“Blood concentrations were obtained for the student and seven family members who were living in the mobile home. Blood mercury levels ranged from 32 µg/L to 72 µg/L (normal: 0–10 µg/L). The 24-hour urine mercury concentrations obtained from seven of these patients ranged from 28 µg/L to 496 µg/L (normal: 0–19 µg/L) (4). The student had the highest mercury levels for both

blood and urine (i.e., 72 µg/L blood and 496 µg/L for initial urine concentration). Urine mercury concentrations were directly associated with amount of time spent in the mobile home. Three of the children, including the student, lived in the contaminated home for 15 months and had urinary concentrations ranging from 193 µg/L to 496 µg/L, whereas three of the children who lived in the home for only 10 weeks had urinary concentrations ranging from 28 µg/L to 68 µg/L. The additional family member, a woman who had not been in the mobile home since June 2004, had a urine mercury concentration of 241 µg/L.

“Several of the children living in the mobile home experienced itchy rashes and headaches. In late 2003, one girl aged 13 years residing in the mobile home had experienced several months of illness consistent with mercury exposure (e.g., unexplained tachycardia, hypertension, desquamation of soles and palms, rashes, diaphoresis, muscle pain, insomnia, vomiting, and behavioral and psychiatric changes). She was hospitalized for approximately 30 days.”

In a different mercury contamination crisis from 2006, another major federal US agency¹⁷ reviewed the impact of exposure to the neurotoxin, given that inhalation is the most dangerous form of exposure:

“Inhalation of high levels of elemental mercury can cause permanent neurological damage and kidney impairment. The MDCH and the Agency for Toxic Substances and Disease Registry (ATSDR) recommends that breathing zone mercury levels not exceed 1,000 ng/m³ for long term exposures as would be likely in a residence, nursing home or other place where people spend a large amount of time. They recommend levels not exceed 3,000 ng/m³ in non-residential settings where nobody spends more than a workday and mercury is not usually handled. This recommended level is based on both animal studies and human epidemiology studies that describe the health effects of inhalation of mercury-contaminated air. Workers who were exposed to mercury vapors in an occupational setting exhibited hand tremors, increases in memory disturbances, and slight subjective and objective evidence of autonomic nervous system dysfunction.

“Children exposed to similar amounts of mercury vapor as adults may receive larger doses because of greater lung surface area relative to their body weight. Their lower body weight and higher intake rate can result in a greater dose of mercury per unit of body weight. Children tend to be shorter in stature than adults, thus their breathing zone is nearer the floor where higher mercury levels are typically found. Children also engage in activities such as crawling and rolling around on the floor. Given that mercury affects the nervous system and that the neuropathways of children (<15 years old) are still developing, children can sustain permanent damage if the mercury exposure reaches toxic levels during critical growth periods.

“*Children who inhale significant amounts of metallic mercury vapors may develop a disorder known as acrodynia, or “pinks disease.”* The symptoms of this disorder include severe leg cramps; irritability; and abnormal redness of the skin, followed by peeling of the hands, nose, and soles of the feet. Itching, swelling, fever, fast heart rate, elevated blood pressure, excessive salivation or sweating, rashes, fretfulness, sleeplessness, and /or weakness may also be present. *This disorder may occur, in some cases, when exposure lasts for only a few days.*” [Investigate’s emphasis]

The Lighting Council’s Richard Ponting told *Investigate* his members have faith that international standards will protect the public:

“The LCNZ membership accounts for approximately 80% of the CFLs imported into New Zealand. We are therefore confident that the majority of CFLs entering the country are manufactured to specifications widely accepted as in accordance with good international practice in all respects including the maximum mercury content. They would also be RoHS compliant or of similar quality if imported from the US.”

Except, the Maine study involved bulbs manufactured to current US standards. Based on the very latest scientific data, unless those standards include manufacturing an unbreakable light bulb, they’re probably not worth the paper they’re written on. New Zealand’s new CFL standards will be equally worthless.

Regardless of the power play over CFLs, there is some light at the end of the tube for householders. Firstly, National leader John Key has signaled that compulsion is not part of National’s vocabulary, and that he’s also concerned about reported safety issues.

Key told *Investigate* magazine a National Government will revisit the “compulsory” rollout of CFL bulbs next year, and that it could well be changed.

“Our main view from the National Party is why should it be a blanket ban? We should encourage people to have them, but not necessarily a blanket ban.”

Additionally, for people who want to save power but don’t want to risk mercury poisoning in the home, high efficiency halogens are coming on the market to replace incandescent bulbs. Given that two scientific studies now warn of the risks of mercury poisoning in the home from CFLs, the smart money in lighting says it’s a good time to buy shares in a halogen bulb manufacturer.

ENDNOTES

1. “Technical specifications for compact fluorescent lamps with integral ballast”, report to EECA by David Cogan BSc, CEng, MIEE, MIPENZ, MIESANZ, APEC Energy Efficiency Standards Co-ordinator
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