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Global Toxicity: Chemicals – A

Worldwide Nightmare

(Highlighting the Castlereagh Waste

Management Centre and its Impact on

Londonderry Sydney)

By

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Cover photo: Castlereagh Waste Management Centre by Stephen Paul

Dawe

To:

What's left of the natural environment,

And a renaissance in unlearning

CHEMICALS – A WORLDWIDE NIGHTMARE (HIGHLIGHTING THE CASTLEREAGH WASTE MANAGEMENT CENTRE AND ITS IMPACT ON LONDONDERRY, SYDNEY)

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Preamble

Please note that I use spelling throughout this document (excepting for quotes) in accordance with ***The Heritage Illustrated Dictionary of the English Language, International Edition*** (American Heritage Publishing Co., Inc. 1975).

This means, necessarily, that I use *American* spelling, not English/Australian.

Acknowledgements

Various staff and students at the University of Western Sydney – Hawkesbury, and other individuals have provided invaluable assistance toward the furtherance of this ongoing study. This assistance has been provided in the form of fieldwork, the highly practical arena where important soil and water samples are gathered.

Also, water and soil tests in the University laboratories have added valuable data over the years. In other areas, private citizens have partaken in interviews, and offered opportunities for soil and water testing. Without these many participants, no hard data or first-hand information could have been effectively garnered to be used as the basis for analyses.

In 1995, agriculture students participating in many of the above contributions were: Joanne Adams, Rachel Austin, Leah de Glas, and Erin Shonk. Faculty of Agriculture (now Faculty of Environmental Management and Agriculture) staff member and Senior Technical Officer, Mark Emanuel, was particularly helpful in 1995 with regard to the water tests performed revealing unusual levels of sodium chloride and low-range phosphorus.

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particularly bore water heavy metals tests.

Further thanks go to Mr. Alan mills and Ms. Marian Streicher.

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PREFACE

This assignment is based on a past study of a significant local issue, this being the operation of the Castlereagh Liquid Waste Disposal Depot (located in Londonderry/Berkshire Park, on the north-west edge of Sydney, Australia).

During 1995, when studying Systems Agriculture at this University, I became aware of the volatile nature of this environmental, agricultural, community and political issue. The issue centers on a considerable list of alleged problems associated with the waste dump. These problems have been described (by landholders living around the waste depot, the media, student and professional science research) in terms of pollution leachate moving onto properties surrounding the dump. From the perspective of local landholders, extraordinary and disturbing occurrences on their properties relate to toxic effects arising from liquid waste. In the minds of many in the community surrounding the dump (including residents in 'non-affected' areas), **the source of the chemical pollution is the Castlereagh dump located geographically at the center of the affected properties**.

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Executive Summary

The Castlereagh Liquid Waste Disposal Depot (or the Castlereagh Waste Management Centre, located at Berkshire Park) is described as a secure landfill, “for the disposal of industrial liquid wastes *although+ eighty-six percent of the wastes disposed… are either solid or semi-solid residues from the *Lidcombe Liquid Waste Plant+” (Waste Management Authority of NSW 1991:8,23). The Metropolitan Waste Disposal Authority (MWDA) opened the Castlereagh Depot in 1974 to provide “an interim solution for the disposal of liquid, sludge and drummed industrial wastes until a planned treatment facility is developed by the Authority” (Waste

Management Authority of NSW 1991:8).

Site disposal methods center on the waste cell, this being “an earthen compartment… into which solid or liquid wastes are discharged and covered” (Waste Service NSW 1995b:69). This form of waste burial is premised on the assumed low permeability of Londonderry clay, which assumptions have, since 1990, come under fire from a concerned public. This has resulted in extensive media coverage, the setting up of a Community Monitoring Committee (to provide community input), and the eventual announcement of the proposed closure of the waste site. Alleged negative impacts from leaking depot waste have created a media issue of considerable political and social proportions. Landholders around the depot site fear that leaking waste is responsible for polluting their properties and generating animal and human genetic and somatic disease symptoms.

The Environment Protection Authority (EPA) has made **admissions of groundwater pollution under the depot**, and bore tests have confirmed the presence of contaminants on and off site. However, Waste Service NSW continues to deny that local environmental problems relate to the depot. This is somewhat surprising when modern research on diffusive pollutant transport (Rowe 1994) shows clearly that clay liners not only leak, but will do so *against* an incoming flow of water into the cell depository.

This study has examined the pollution issue firsthand by pooling soil and bore water test results from two successive years’ University of Western Sydney Hawkesbury student investigations of a property 2 km from the waste dump. The results tend to confirm that the property is significantly contaminated with substances as diverse as salt, phosphorus and heavy metals. Health problems (including arsenic heavy metal poisoning) in both occupants of the property, supports the claims of many residents around the waste site that chemical wastes are posing a serious threat to the health and equity of landowners, their children, pets and livestock.

Indeed, a study of a major environmental consulting firm’s groundwater monitoring results and

toxicological literature research confirms a decided synchronicity between types of wastes disposed at the depot, those *leaking* from the depot (as proved by the groundwater results) and morbid symptoms in affected residents.

This report recommends that better methods of waste disposal be sought with vigor (eg incineration), that full accountability for waste leakage and environmental degradation be made known to the public (and appropriate prosecution take place), and that generous compensation for property damage and human/animal disease caused through the waste leakage be forthcoming.

1. Description of the Landuse Program

HISTORY OF WASTE SITE

Location and Setting

The Castlereagh Liquid Waste Disposal Depot, situated 7km south west of Windsor, was originally 8 ha in size in 1974 (Bender, Wilmott and Zuel, 1990), but has now expanded to 350 ha plus (Total Environment Centre Inc. 1996:1), with this area including a 100 ha buffer zone (Bender, Wilmott and Zuel, 1990). It is operated by the Waste Service (Hartcher 1994). The depot is bounded by the Castlereagh State Forest to the south, the suburb of Berkshire Park to the east, the John Moroney Correctional Centre to the north, and the suburb of Londonderry to the west. The physical characteristics of the depot surrounds indicate that the area was once extensively timbered. It has, in parts, evidence of wetlands.

Waste management literature states that the current depot site was chosen “because of the extent and qualities of the Londonderry Clay which underlies the site” (McCotter & Associates 1993:6.5).

Chronology

Officially the Castlereagh Waste Depot was opened by the Metropolitan Waste Disposal Authority (MWDA) in 1974. It has been said that the Department of Main Roads formerly

excavated earth at this site to be used as road base. This *may* explain the appearance of earth works on aerial photographs taken before 1974 (see **Appendix 1** for copies of these photos). However, it has also been noted that the earthworks may be the result of unrecorded waste burial at the depot site before its official sanction (Luland, C. 1995, pers. comm. 26 April).

The Castlereagh Depot originally opened as an interim solution "to meet an urgent need for an environmentally acceptable disposal facility for Sydney's industrial liquid and sludge wastes… only until permanent facilities were established" (Waste Service NSW 1995b:23). In 1988 the "Aqueous Waste Plant *was+ constructed" in Auburn which "can convert up to 55,000 tonnes of industrial wastes into liquid suitable for discharge to the sewer". As a result, "quantities of waste needing to be directed to Castlereagh have significantly declined" (Waste Service NSW 1994:1,4-5; 1995b:23).

In the late 1980s, early 1990s, the local community of Londonderry (in particular, landholders near the depot) began to report an increasing incidence of disease symptoms. Also of concern was an apparent negative impact upon the agricultural viability and general biodiversity of the area. The cause is considered, by some, to be chemicals leaching from the toxic waste site. Reports of birth defects, together with over a hundred alleged cases of animal and human health problems, prompted Waste Service NSW to commence conducting Environmental Audits (EA) (Hill, K. 1995, pers. comm., 27 February).

In 1990, as a result of this public concern, the Martyn Report, "recommended the current environmental audit process *and+ in 1992 the 'Castlereagh Action Plan' was established so that the environmental audit process could be complimented by the other investigations. These include the human health, animal health, plant and wildlife components" (Williams & Jalaludin 1993:i).

In 1992, an environmental Stage I Audit of the Castlereagh Depot "was undertaken for the New

South Wales EPA [which led to a] Stage II Audit program [the purpose of which] was to obtain an accurate assessment of the current environmental risk associated with the Depot and to develop a monitoring program which will provide the necessary information to signify any change in that risk status" (Woodward-Clyde 1994:ES-1). After the release of the Stage II Audit, Waste Service NSW (1994:1) said that "no contamination was found outside the site *and that+ the potential for movement of waste chemicals off the depot is considered to be slow". Also, the same publication noted that the draft of the Stage II audit found that "the potential for adverse impact of waste chemicals... *is+ negligible". Further to the above, Waste Service NSW (1995a:1) stressed that the Audit "specifically found that there is negligible risk of community exposure to waste-derived chemicals. The facility is not leaking".

Also, in 1994, the then Minister for the Environment, Chris Hartcher, stated that the AGC Woodward Clyde examination of the waste depot concluded that, "there is no evidence of any contamination of surface or groundwaters beyond the boundaries of the depot…" (Hartcher 1994).

Later, however, **the EPA admitted to chemical leakage offsite by way of groundwater contamination** (EPA official 1995, pers. comm., 26 April) (see **Appendix 4**).

In June 1993, the *Castlereagh Secure Landfill Depot – Interim Environmental Management Plan* (1993) was set out detailing various management principles including: water management, sedimentation controls, leachate/landfill gas/litter/dust/odor/pest & weed, and accidental spill controls (see **CURRENT MANAGEMENT PRACTICES**, below).

A human and animal health study was commissioned by the State Government in 1994 (Hartcher 1994). That study resulted in an 'inconclusive' assessment. Nevertheless, an "alert status [was] adopted in relation to [the+ health outcomes…" (Williams & Jalaludin 1994:v).

On April 21, 1995, "the Minister for the Environment, the Hon Pam Allan, MP, announced that the operation of the Castlereagh Waste Management Centre (WMC) would be phased out [and]

on 18 May, 1995, the EPA issued *a+ Legal Notice… requiring Waste Service to submit a closure Plan for the Castlereagh Waste Management Centre by 31 May, 1995" (Waste Service NSW 1996:1).

In 1996, the Total Environment Centre Inc. published its *Castlereagh Waste Disposal Depot Report on Community Concerns and Adequacy of Government Investigations*. In this report the Centre refuted the major groundwater modelling assumptions and conclusions made by Woodward-Clyde in their Stage 2 audit of 1994.

At the 29 January, 1997 Closure Consultation (tenth) meeting of Negotiated Solutions (depot closure facilitators), which I attended, the "Expert Review Panel (the "ERP")… were introduced by Mark Lane *Closure Manager, Waste Service NSW+…*who+ confirmed that the *ERP+ members were *independent of Waste Service although paid by it* [and were nominated and hired] to *provide unbiased technical assistance*" (Walker 1997:4) (emphasis mine).

The closure facilitation is an ongoing process at the time of printing this report.

CURRENT MANAGEMENT PRACTICES

Waste Service NSW designated the Castlereagh depot as a special landfill site. It is the only one of its kind in Sydney and at present receives waste in the form of sludge from the Lidcombe aqueous waste plant (Waste Service NSW, 1994: 1,4). The waste deposited consists of approximately 29 categories of waste products (Metropolitan Waste Disposal Authority, 1977:Exhibit H). This might include up to 115 various chemical products, with cadmium and arsenic among them (Waste Service NSW, 1996:Appendix IV) (see **Appendix 6** for these lists).

Landfill Management

Construction of Waste Cells

The clay cells are 20 m long and are a minimum of 3 meters above the underlying strata (Waste Service NSW, 1994:1-2). In this way, a minimum of 3m of "undisturbed clay… *is+ left beneath any waste disposal cell [with] an impervious clay bund… constructed around each working area

of the site; *then the+ liquid waste… *is+ absorbed by solid waste *eg household waste (Waste Service NSW, 1994:1-2)+" (McCotter & Associates 1993:6.5). This mixture is then encapsulated within a clay liner, with the final capping of a 3.5 m bund wall of compacted clay which seals the pit (Waste Service NSW, 1994:1-2). At current waste disposal rates it takes one week to fill one cell at a rate of 66 tonnes per day (Jones, A. 1996, pers. comm., 5 September). The use of this type of landfill technology, in current use throughout the world, is argued to enable rapid detection of leakage into groundwater through the use of small cells, although any change in the angle of flow from the cells (i.e. in the event of major flooding, earthquake, etc) can cause a major leakage problem (Bedient, Rifai, & Newell 1994:71).

Water Management

The depot has, in the past, based its water management of disturbed areas on internal drainage dynamics. Along with this, sediment traps control discharges from these areas. Overflow from sediment ponds, on the depot's northern boundary, enters Main Stream, this being a tributary of Rickabys Creek. Bushland in Area 11 (northern part of the depot) acts as an additional filtration buffer for water before it exits via filtration and precipitation (McCotter & Associates 1993:6.1). More specifically, catch drains delineate sub-catchments and provide for the separation of runoff from each. Also, disturbed area runoff is kept separate from that originating in undisturbed areas as much as possible. All drainage structures (as of June 1993) were said to be targeted for design in accordance with the CALM *Draft Urban Erosion and Sediment Control Manual* – 1992 (McCotter & Associates 1993:6.2).

Leachate Control, Collection and Disposal

Leachate control is based on the 3m undisturbed clay barrier beneath each cell, impervious clay around each working area, the absorption of liquid into solid waste, and the backfilling of all cells with a clay plug (McCotter & Associates 1993:6.5).

Together with the above, the monitoring of groundwater is considered important and the ability

to rectify any contamination eventuating would be easily managed. Also, although leachate production is considered a normal result of site activities, the amount of leachate generated is considered to reduce over time due to water usage by vegetation. Along with this, there is predicted to be a likely decline of infiltration via the agency of humus (McCotter & Associates 1993:6.7-8).

Leachate collection and disposal will occur through via systems that keep leachate separate from surface waters (to avoid contamination of Main Stream, Rickabys Creek and other watercourses). This 1993 document describes collection and disposal arrangments in terms of plans to devised with EPA input (McCotter & Associates 1993:6.8).

Landfill Gas Control

Landfill gas (methane and carbon dioxide) is estimated to generate at "approximately 1500 cubic metres per hour for each million tonnes of waste" (McCotter & Associates 1993:6.9). This document details the possible inclusion of a gas collection and control system should gas emissions become a nuisance, for the efficacy of rehabilitation of plant life, and for potential commercial uses of the gas. The possible inclusion of this system would occur progressively, along with overtopping of cells and disturbed areas (McCotter & Associates 1993:6.9).

Premises Associated With Management Practices

The Safety Premise

Waste Service NSW argues that liquid moves through the "clay at the depot at a rate of about 1 metre every 17 years" due to the low permeability of the clay (Waste Service NSW 1994:2). According to these figures, it would take approximately 46 years for the waste to travel down from the cell to the groundwater. These statements are thoroughly dismissed by the Total Environment Centre Inc publication, *Castlereagh Waste Disposal Depot – A Report on Community Concerns and Adequacy of Government Investigations* (total Environment Centre Inc. 1996:8).

Some of the hundreds of bore sites around the depot are monitored on a regular basis (Jones, A. 1996, pers. comm., 5 September). We feel that the inclusion of these bores somehow provides a false sense of security for Waste Service, at least in regard to their public relations. Ultimately, though, any authoritative public announcement of waste leakage (given that honesty would prevail) would likely not provide any real measure of assurance for those affected, given the devastating events that have already impacted on so many Londonderry landholders. All it would do, at the very most, is signal an environmental catastrophe long after the event has taken place.

Problems with Premise

It has been stated by Waste Services NSW that seepage of contaminants into the groundwater has not gone beyond the depot boundary (AGC Woodward-Clyde 1994:ES-9), yet 26 assumptions made in this water consultant firm's report have been questioned (Perry 1996:15).

The "inappropriate permeability measurements taken" (Perry 1996:15) seem to auger poorly for the report's professional standing and conclusions when it has also been stated that, "…1/3 of the waste leaks out of a cell in 3 years and almost all of it leaks out in 20 years" (RAGE 1995a:1).

This indicates that toxins are present in the depot groundwater, however Waste Services say that the 'perched groundwaters' under the site are "isolated bodies of water-saturated soil" and are "therefore not a pathway for the transport of chemicals off-site" (Waste Service NSW 1994:4). Even if these statements were true (our study has determined that they are not), a flood may well be sufficient to invade these groundwaters and thus lead to the spread of contaminants.

Also, landfill technology does not have a good track record internationally as a method of waste containment. As part of its report to Congress, the US EPA identified 163 cases where environmental or health impacts could be documented. In 146 of these cases, groundwater

was affected, and 35 cases showed contaminated drinking water as having impacts on human health and aquatic life. The extent of environmental degradation was related to the degree of waste infiltration and the flow rate of groundwater (Carra 1990:230).

ENVIRONMENTAL AND HUMAN HEALTH STUDIES

As well as the EPA's above-listed efforts (see under **Chronology**, page 2), the EPA has also generated "a preliminary air monitoring program *showing+ that the air at Castleareagh WMC was no different to the air at a site remote to the centre" (Waste Service NSW 1995b:24). (As an aside, here, this report would like to question the rather cryptic nature of the last quote. A more specific statement would, we think, be in order.) The same publication also noted that "a more comprehensive program to determine air quality over a 12-month period" is under way. I could point out here that perhaps the "site remote to the centre" should also undergo this monitoring, since it has the same air – whatever that is; this was *not* specified – as the Depot.

Other government bodies have also generated a variety of studies on the Depot. These include NSW Health and NSW Agriculture. All reports have claimed "no substantiated link between the WMC and reported phenomena in the surrounding community" (Waste Service NSW 1995b:24).

Human Health

The Western Sector Public Health Unit's *Castlereagh Human Health Study* has determined an inconclusive outcome in regard to a link between human health problems and leakage of waste (see **Appendix 4** for aspects of the Human Health Study (HHS) Report given at a CMC meeting in 1995). They noted that no clear "pathways of exposure" can be established, so the real extent and outcome of the health effects of the site cannot be measured (Williams and Jalaludin 1995: v). In other words, "the study was not able to identify any association between adverse health outcomes and the Castlereagh Waste Management Centre (CWMC)" (Refshauge 1998).

However, the concern over depot-related illness and animal deformities continues. In recognition of this, Andrew Refshauge MP (Deputy Premier, Minister for Health and Minister for Aboriginal Affairs) has stated the following:

In view of ongoing concerns for the health of residents living near the CWMC, I am advised that officers from the Department's Environmental Health Unit have recently met with the officers from the Environment Protection Authority to facilitate the establishment of a health monitoring program.

It is proposed that the health monitoring program will be established by the Western Sector Public Health Unit as soon as funding issues are finalised within the Health Department. It is also proposed that the Western [Sector] Public Health Unit analyse and report on routinely collected health data each year for at least the next five years. These reports will then be disseminated widely to all interested parties.

I wish to assure the community that my Department does take this issue seriously. I trust that the foregoing information helps to allay the community's concerns with the establishment of a health monitoring program (Refshauge 1998).

If the previous Human Health Study found that brain cancer rates in males were more than three times the NSW average, breast cancer rates 2 ½ times and uterine cancers over five times the average (Kerr, 1995:1-3), but *still* could not define an outcome, then why *should* the community be assured? Please see, for more specific details, **Community Monitoring Committee and Human Health Study,** and also **HUMAN/ANIMAL/PLANT PHYSIOLOGIC POISONING NEAR DEPOT: Part 1, below.**

Animal and Soil Health

Soil. The NSW Department Of Agriculture's publication, *Castlereagh Waste Management Centre – Animal and Soil Health Reports: Executive Summary* (1995:2) listed results from their soil survey of five respondents in Bligh Park, South Windsor and Londonderry who were having

problems growing plants. The conclusion reached stated that four of the five respondents had unbalanced soil fertility. The “use of mushroom compost and poultry manure *was+ encouraged” (NSW Department Of Agriculture 1995:2).

Animal. The NSW Department Of Agriculture’s publication, *Castlereagh Waste Management Centre – Animal and Soil Health Reports: Executive Summary* (1995:3-5) minimizes any potentiality of the waste dump contributing significantly to any reports of animal health problems. See **HUMAN/ANIMAL/PLANT PHYSIOLOGIC POISONING NEAR DEPOT: Part 1**, below., for further details.

2. Impacts of the Landuse Project on the Environment and Politics

Author: Murray S. Thompson. Specifically, 1996 soil/water sampling: Murray S. Thompson and Stephen Paul Dawe; 1996 soil moisture, organic matter tests, results and analyses: Murray S. Thompson; Heavy metals’ determinations: Sue Cusbert (Technical Officer, UWS-H), and Sharon Birmingham (Senior Technical Officer, UWS-H), with the participation of Murray S. Thompson, Stephen Dawe and Shahrooz Nouri; Heavy metals’ analyses: Murray S. Thompson.

Introduction

The media has been unquestionably central to the ongoing furor generated over alleged contamination of properties near the Castlereagh Liquid Waste Disposal Depot at Londonderry / Berkshire Park. Both sides of the heated issue -- the State Government (along with the EPA and Waste Service NSW) and local landholders (along with RAGE *Residents' Action Group for the Environment+) -- have used the media to alert the public to perceived mis-truths and contradictions. However, the overriding focus and theme of all statements and exchanges has been the **negative impact of chemical contaminants on property viability and human and animal health**. If we are to believe what the Londonderry landholders are saying, then indeed there has been a significant degradational influence upon the terrestrial environment of the extended Londonderry region.

Impacts Discussion

DIRECT, NEGATIVE IMPACT ON LOCAL LANDUSE

Considering that there has been "one million tonnes of liquid waste... dumped at Castlereagh over the past 20 years" (Kerr, 1995:3), it may not be surprising then that locals in the area surrounding the waste depot have been the first to announce the nature of the perceived threat from the dumpsite:

[An anonymous property that is] about 4 km from the Castlereagh Liquid Waste Disposal Depot, has joined the voices calling for a public inquiry into the depot.

On two occasions *this property owner's+ animals became agitated and nervous after heavy rain and behaved as if the wet ground was burning them...

[The] land is above the water table and [the owner] believes water from the liquid waste depot may be seeping through the ground up to the surface of her property (Bender 1990:3).

The same article showed that the State member for Londonderry, Paul Gibson, was one of many

claiming that the *above+ farm's problems were connected to other occurrences in the area, with the common link proposed as being the liquid waste depot (see **Appendix 3** for interviews with the anonymous Londonderry landholder).

In large block letters on page 1 of the April 10, 1990 Penrith Press was the following headline: "WHAT'S KILLING LONDONDERRY?" The article highlighted a number of things:

• Animals are dying; vegetables are dying; dams and creeks are covered with film; water courses are spewing froth; eels, fish and mussles have died; people are experiencing skin problems; horses are behaving strangely; frogs have disappeared, and animals are reportedly born deformed or dead.

• The people of Londonderry, a rural and farming community, are frightened and many of the farmers face financial ruin.

• Mutated animals continue to be born, eg goats with no skin.

• Water appears to be the common link in all these problems, particularly after rain. Animals die after drinking and stock refuse to drink.

• All the properties affected are located between the waste disposal depot and the Nepean River (Prisk 1990a:1-2).

UNSAFE ENVIRONMENT FOR RESIDENTS, AND AUTHORITY 'CONCERN'

Another point can be made regarding the Carrington Road property of Frank Demanuele. Demanuele says the water lilies are now dead in his dam, and both the eels and fish are dying (Bender et al, 1990). The article continues:

Over the past two years both the State Pollution Control Commission and the Waste Management Authority (which operates the nearby liquid waste depot) have tested Mr Demanuele's property. The WMA has a padlocked bore hole on his property which is used for tests every two months.

So far he has not received a written report on any of those tests: "I keep getting told

‘Frank there’s nothing wrong’, but why did my lawns die and become bare dirt? Why did 80 native trees just die? No-one wants to take responsibility” (Bender et al, 1990).

If there’s no “cover-up”, as the Waste Service NSW (1995a:2) newsletter assures, then why no written reports for the owner of the property? Are test results being kept under wraps?

Note this further indictment against the “no leakage” statement of Waste Service NSW (1995a:1). Ted Books, a Hawkesbury Council alderman, was moving earth at Londonderry in 1978 on a property next to the Depot. After turning over 2m of soil he noticed a “gas” being emitted. Not long after this Mr Books couldn’t breathe and felt very ill. He had a bitter chemical taste in his mouth for weeks after the incident. Although having reported the matter to the SPCC, Mr Books was not contacted again after an initial questioning session by one of its officers (Bender et al, 1990). Also, note this comment from the “WMA’s technical manager Ross Thomas [who] said problems on [the anonymous Londonderry landholder’s+ land was not the authority’s responsibility” (Bender 1990:3).

SAFEGUARDS?

According to the WMA, the Depot site is “surrounded by a wall of highly compacted clay to stop the movement of liquid under the ground. A series of 5m deep cells are dug, leaving 3m of impermeable clay below each cell to discourage the downward movement of any liquids. Liquid waste and the cells are covered with 3m of clay” (Bender et al, 1990).

The 1995 Waste Service NSW Newsletter assures us that “in addition to the preexisting and new groundwater monitoring bores..., there are approximately 120 shallow bores testing individual waste cells and 180 bores into the Londonderry clay. The site is completely surrounded by these Londonderry clay bores” (Waste Service NSW, 1995a:5).

If Frank Demanuele is not told what is in the WMA padlocked bore on his property, then why should we believe anything we’re told in regard to the 300 or so bores surrounding the Depot

site?

ISSUE IMPACT ON POLITICS – GOVERNMENT RESPONSE

Calls for Inquiry and Contradictory Test Results

The Penrith City star of 27 March, 1990, noted that the State Government had ordered a public inquiry into the depot, "following water sampling in surrounding properties" (Kelly 1990). The same article listed the following alarming details:

> Environment minister Tim Moore has agreed to inspect the area... after the matter was raised in State Parliament last week... The move follows a string of alarming incidents in which animals have died and 20 market gardens in Londonderry destroyed.
> Results of sampling commissioned by Mr Gibson indicated that 1.1 mg of petroleum hydrocarbon were present in each litre of water taken from two dams in the local area (Kelly 1990).

In all the above, we observe politicians supposedly/hopefully expressing earnest desires to see proper action taken, although one becomes skeptical that action will be unbiased and actually result in real and equitable benefits for those who may have been wronged. One also must begin to wonder why the Prisk (1990:1-2) article noted that the State Pollution Control Commission (SPCC) "do not know which chemicals to test for on properties and some individual tests can cost up to $400 each", and that the "SPCC regional manager (southern Sydney), Tony Hewitt, said the authority didn't have the expertise for the examination of dead animals which he believes may be the key to the problem". It is also somewhat unfathomable how the SPCC and WMA (Waste Management Authority) should arrive at a "nothing wrong" analysis and conclusion in regard to local water (Bender 1990:3) when Gibson's tests *did not* (see **Appendix 7** for heavy metals test results on the Anonymous Londonderry property, **Appendix 2a** and **b** for the property maps and photos, and **Appendix 5** for **RAGE** newsletters on the waste depot).

Handicapped Inquiry

An unbiased exposure of truth and a determined will to compensate any adversely affected does not, however, seem to be on the agenda of any who might be able to hide culpability beneath pleas of chemical testing ignorance and expense, or the specific lack of solid and demanding absolute proof.

As matters turned out, the Penrith Press of 24th July, 1990 said:

The troubled inquiry into problems around the Castlereagh Liquid Waste Disposal Depot was dealt a blow from within last week by State Member for Londonderry Paul Gibson.

A member of the community committee of inquiry established by State Environment Minister Tim Moore, Mr Gibson previously had been reluctant to comment on its workings but last week he labelled the inquiry “a farce”...

As revealed in the Penrith Press last month, the committee is being funded by the very body which operates the liquid waste depot under investigation - the Waste Management Authority - which Ms Allan *Opposition environment spokesman Pam Allan] felt compromised the inquiry (Zuel 1990).

The same article quoted Mr Gibson as saying: “Its like the WMA investigating the WMA... the Government will be condemned for not really trying to find a cause for what is happening in the surrounds of Londonderry” (Zuel 1990). Although the then Premier Nick Greiner asserted the Government was determined to ascertain if there was a genuine health risk, it seems that the Government‘s will and credibility is lacking in this type of investigation.

Community Monitoring Committee and Human Health Study

As a result of the burgeoning nature and influence of this issue, further impacts have been noted within the political arena resulting in certain action being taken:

In late 1991 a plan was developed to utilise an independent community mediator to consult widely with residents near Castlereagh, identify issues of concern and bring together in an open forum those with an interest in the Depot.

Following the consultant's work, the Community Monitoring Committee or CMC was established by the Minister's office in November 1992 after release of the first environmental audit of the Depot.

Penrith Council was appointed to convene and chair these meetings. The committee meets in Penrith Council Chambers about once a month and is funded by Waste Service NSW...

The main function of this committee is to manage the Action Plan presented by the Minister in 1992. TheAction Plan comprised:

• The Stage II Audit;

• A human health study and a

• Flora and fauna health study (Waste Service NSW 1995a:6).

The Human Health Study found that the "rate of brain cancer in males *is+ more than three times the NSW average", with "the breast cancer rate between 1979 and 1983... two-and-a-half times the State average, with eight cases identified, while three cases of uterine cancer between 1984 and 1988... *were+ more than five times the average" (Kerr, 1995:1-3). Amazingly, the Waste Service NSW (1995a:1) stated that the major findings of the Human Health Study included *no* increase in the cancer rate. Not surprisingly, though, the outcome of the study was an 'open finding', with "no direct link between health problems and the tip" (Kerr 1995:1-3).

In contradiction of most of the authoritative *political* statements, a RAGE member at the 26/04/'95 CMC meeting said that it appeared that if the Health Study quoted two cases of cleft lip/palate, then it missed five other cases known to exist in the area (RAGE 1995, pers. comm., 26 April). The medical representative from Westmead Hospital delivering the health study findings at the meeting responded that *they* came up with the study area and that this could not be changed now (Westmead Hospital spokesman 1995, pers. comm., 26 April). See **HUMAN/ANIMAL/PLANT PHYSIOLOGIC POISONING NEAR DEPOT: Part 1**, below.

As if to add further contradiction (and straight out *admission* confounding previous assertions) to the entire process involving political reaction and defence, the EPA representative at this same CMC meeting declared, not ten minutes later, that **leakage of cells into groundwater is a fact -- confirmed** (EPA spokesman 1995, pers. comm., 26 April). However, the EPA representative then noted benevolently that prosecution of the Waste Service would not achieve anything in regard to fixing the problem!

Certainly, with regard to the above, it is clear that the Castlereagh project has, through much public controversy, impacted profoundly throughout political and health circles.

LOCAL AND INTERNATIONAL ENVIRONMENT GROUPS

RAGE

In response to the issues of human and animal health surrounding the operation of the Castlereagh Waste Disposal Depot, a local group named RAGE (Residents Action Group for the Environment) formed “at a public meeting in December, 1989” (Total Environment Centre Inc. 1996:1). RAGE (see **Appendix 5** ***RAGE Newsletters***) has been instrumental in making various test results (e.g. bore water tests at the Castlereagh depot) public, along with establishing detailed lists of disease symptoms relating to depot contamination of neighboring properties. RAGE members have been dedicated participants of the CMC and Negotiated Solutions (depot closure) meetings, overseeing, in large part, the activities, pronouncements and conduct of Waste Service NSW, the EPA, and all concerned with the depot issue. RAGE was also instrumental in securing the services of the Total Environment Centre Inc. which has performed an authoritative study on the adequacy (or otherwise) of various government investigations into:

• Mathematical modelling of water and contaminant movements from the Castlereagh Waste Disposal Depot;

• The review of the Castlereagh Waste Disposal Depot Soil Report, Animal Health Study

and Human Health Study;

• Potential exposure pathways to humans, other animals and vegetation from chemicals in the Castlereagh WasteDisposal Depot (Total Environment Centre Inc. 1996:ii,iii).

Greenpeace and Geology

Notably, Greenpeace has also entered the fray and "made its feelings clear on the Castlereagh Liquid Waste Depot in Londonderry" (Penrith Press, 1990b). This article noted that Greenpeace asked for the releasing of data on the Depot by the authority (WMA):

Spokesman Donna Russo said "we have requested detailed information covering monitoring and the types of wastes involved."

"This type of information is essential for public understanding of the situation at the Castlereagh depot", she said (Penrith Press, 1990b).

Greenpeace has revealed some quite startling information in regard to the local geology in the depot site area:

The new [Greenpeace] report says toxic wastes are capable of leaching through the clay and into the permeable gravel layer beneath the clay, which contains the groundwater. This layer, known as Rickabys Creek Gravel, becomes exposed at the surface in areas downhill from, and close to, the dump.

"If chemicals were leaking from the dump, down into the Rickabys creek Gravel, these chemicals could migrate through the gravel and flow to the surface in neighbouring residential areas", the report says.

"Almost all of the reported local problems have occurred within or close to the areas where the Rickabys Creek gravel comes to the surface..."

The WMA states that the clay has very low permeability but Greenpeace says many of the wastes dumped at Castlereagh could cause large increases in the permeability of clay... (Earl 1990:1,4).

The article goes on to say that the dump is “up to 30m higher than the residential and agricultural areas to the west and east [and that] the soil 10-20m underneath the dump emerges at the surface, downhill from the dump...” (Earl 1990). The author also notes that the Greenpeace report relates the surfacing of the gravel layer to all but 2 of the 29 trouble spots where agricultural, stock and human health complaints have arisen.

It is worth noting that one can overlay or compare geological maps (Clark & Jones 1991) and a topographic map (Central Mapping Authority of New South Wales 1983) and see that the Rickabys Creek Gravel associated with the dump site intersects the south-western corner of Bligh Park, a large *residential* complex south of Windsor. Also, *the gravel either underlies or closely borders six significantly affected properties around the waste depot* (see **Appendix 2a *Maps of Properties Near Depot, Including the Anonymous Property***).

INDICATORS OF SEVERE GROUNDWATER CONTAMINATION

The RAGE Hawkesbury-Nepean Newsletter of September 1993 revealed these startling facts:

On 23rd June, 1993, Mr Peter Millington, Director General of the NSW Department of Water Resources, issued a press release stating that “There is no evidence that any contaminants have as yet moved into the groundwater system” under the Castlereagh Toxic Waste Depot.

Mr Millington also points out that the Department of Water Resources has the responsibility to ensure that surface and groundwater resources are protected.

The press release seems to indicate that the Department of Water Resources has not read previous groundwater testing data on the Depot. Had this data been checked they could have found that a sample taken from borehole 107 on 11th December 1989 was 92,000 times the Clean Waters Act limit for phenols. Other readings from borehole 107 have been 27,000 times, 24,000 times and 24,500 times the legal limit. Borehole 131 has been 46,000 times the limit, borehole 105 has been 19,300 times

the limit, borehole 106 has been 13,000 times the limit and borehole 943 has been 8,950 times the limit.

...Auditors AGC Woodward-Clyde... have also announced that elevated organic carbon concentrations (>20 mg/L) have been detected in a number of bores including 906 (43 mg/L), 915 (20 mg/L), 918 (296 mg/L), 927 (81 mg/L), 934 (77 mg/L) and 942 (20 mg/L). Of these bores 906 is ***outside*** the depot and 942 is ***on the depot boundary*** (RAGE 1993:3) (emphasis mine).

Further to this, a RAGE media release (RAGE 1995b) reported that the EPA has actually legalized the contamination of the groundwater beneath the depot "by establishing an authorised discharge point". If this were not enough, another RAGE media release (RAGE 1995c) noted that the EPA has declared that "concentrations of volatile halogenated compounds appear to be higher than measured during the *Woodward-Clyde Stage II+ Audit". Interestingly, Waste Service questioned the credibility of their usual ally, the EPA.

HUMAN/ANIMAL/PLANT PHYSIOLOGIC POISONING NEAR DEPOT: Part 1

Human Health

The Western Sector Public Health Unit's *Castlereagh Human Health Study* has determined an inconclusive outcome in regard to a link between human health problems and leakage of waste (see **Appendix 4** for aspects of the Human Health Study (HHS) Report given at a CMC meeting in 1995). They noted that no clear "pathways of exposure" can be established, so the real extent and outcome of the health effects of the site cannot be measured (Williams and Jalaludin 1995:v).

The above statements are called into question by the Total Environment Centre Inc publication, *Castlereagh Waste Disposal Depot – A Report on Community Concerns and Adequacy of Government Investigations* (1996:8). This study notes deficiencies in the HHS, these being:

• That the researchers did not take into account that 75% of households included in the study

"indicated that they had noticed unusual problems with the soil and water on their properties including discolouration of the soil and surface water with an oily film, wildlife which were dead or sick and vegetation that died or did not grow well" (Total Environment Centre Inc.1996:38);

• That researchers were not alerted by reports that "these problems *occurred+ specifically after rain" (ibid);

• That researchers also were not alerted to the fact "that 43% of respondents indicated outcrops of Rickabys Creek Gravel on their property. The Rickabys Creek Gravel is associated with the flow of groundwater" (ibid);

• That the researchers should have considered these findings and understood that "**there may be exposure to contamination resulting from ground or surface water**" (ibid);

• That the HHS "**should have considered the exposure pathway between humans and potentially contaminated soil or food on their properties**" (ibid);

• That the HHS "did not investigate, or even recommend investigation of the problems the majority of respondents were experiencing. **Field sampling should have been carried out to check for contamination of soil and water on these properties. If this work had occurred then a pathway of exposure may have been identified**" (ibid) (emphasis theirs).

See also, **IMPACT ON POLITICS, THROUGH THE ENVIRONMENT**, below for further details.

Animal and Soil Health

Soil

The NSW Department of Agriculture's publication, *Castlereagh Waste Management Centre – Animal and Soil Health Reports: Executive Summary* (1995:2) listed results from their soil survey of five respondents in Bligh Park, South Windsor and Londonderry who were having problems growing plants. The conclusion reached stated that four of the five respondents had unbalanced soil fertility. The "use of mushroom compost and poultry manure *was+ encouraged" (NSW Department Of Agriculture 1995:2).

The Total Environment Centre Inc publication, *Castlereagh Waste Disposal Depot – A Report on Community Concerns and Adequacy of Government Investigations* (1996) (see **Appendix 2a 2. *Locations of Reports of Groundwater Pollution***) noted the following deficiencies in the NSW Department of Agriculture's study on plant growth problems:

• The "NSW Agriculture report is undated, [so] it cannot be determined if it was carried out before or after the compilation of episodes of human, other animal health and vegetation problems gathered over four years from 1990-1994 by RAGE (Total Environment Centre Inc.1996:31-32);

• Only **one** out of 21 residents' reports on vegetation problems "was included in the NSW Agriculture study.

If the NSW Agriculture Soil study preceded the RAGE list [given below] it would have been essential to carry out a follow up study when this information became available" (ibid:32);

• The report fails to address the fact of large trees dying in the Londonderry area (ibid);

• The report's conclusion ("… The soils are naturally very poor… it is very important that an intensive program of building up the soils be undertaken" *NSW Department Of Agriculture 1995:2+) "is inadequate and does not explain how trees and plants were able to grow in the first place, under apparently very poor conditions, before they suddenly died" (Total Environment Centre Inc.1996:32);

• The report failed to address a significant problem relating to market garden operations in the Bligh Park area.

These ventures used water from South Creek for irrigation, resulting, in some instances, in vegetation loss of a considerable magnitude (e.g. the destruction of 8,000 capsicum plants; "five acres of beetroot, water cress, parsley, shallots, onions and radish", and the death of 10 chestnut trees). The South Creek irrigation water may have carried chemicals onto the properties which may still be contaminated with residues. "This would warrant further

investigation." Also, other potential sources of contamination of South Creek other than the waste depot should have been investigated (ibid).

Animal

The same NSW Department of Agriculture's publication (1995:3-5), minimizes any potentiality of the waste dump contributing significantly to any reports of animal health problems. This report's basic findings can be summed up as:

• "There is scant evidence supporting a claim that the rate of any particular animal disease near the CWDD *Castlereagh Waste Disposal Depot+ is normal or abnormal" (NSW Department Of Agriculture 1995:3);

• "There is minimal evidence to confirm or deny that the CWDD causes disease in animals" (ibid);

• "Very little *is known about the effects of ground fill hazardous waste disposal on animal populations+" (ibid:5).

The Total Environment Centre's publication, (1996:33) then noted the following deficiencies in the NSW Department of Agriculture's animal health study:

• "The AHS *Castlereagh Animal Health Study+ states that epidemiological studies require large numbers of cases to draw inferences from and yet discounts an important source of data collated by the local community through RAGE. As a result, the community has a lack of confidence in the outcomes of the AHS because their concerns were not adequately addressed" (Total Environment Centre Inc.1996:33);

• "A major flaw of the AHS is its failure to carry out a control study in an area with similar characteristics as the study area but without the potential of contamination from the CWDD. While the report acknowledges this limitation (*executive Summary, p4*), it would have been possible to carry out a complimentary survey of animal health in neighbouring suburbs using the same surveying process employed in the AHS. This information… would have assisted the report to come to useful conclusions" (ibid).

• “The most disturbing aspect of the AHS has been the way in which it has been used by some authorities as proof that there is no connection between the CWDD and perceived increases in animal health problems in the area, when the AHS itself states that ‘ *There was minimal evidence to confirm or deny that the CWDD causes disease in animals’. (AHS Executive Summary)*” (ibid).

HUMAN/ANIMAL/PLANT PHYSIOLOGIC POISONING NEAR DEPOT: Part 2

Test Location: The Anonymous Property in Londonderry

The test results (see **Appendix 7** ***Heavy Metals Printout & Method***, **Appendix 8** ***Soil Test Results for 1996 & Method***, **Appendix 9** ***Graphs for Soil & Water Tests***, and **TABLE 3** ***Detailed Results -- 1995 & 1996 Tests Combined*** on or near page 27) and various exchanges of information/opinion required for analyses in the following section will include past results from interviews and tests gathered on behalf of student group agriculture and environmental assignments executed in 1995/96 and headed by myself.

The anonymous husband and wife team moved to their current property in 1967. It is located south west of the Castlereagh Depot. The property had a great many animals on it that were affected by toxic waste.

General Results From Conversation

Physiologic Poisoning (1995) -- Human and Animal

The owner of the property from which Steve and Murray drew bore water and soil samples (the husband has had to work off the property due to notably diminished health after the appearance of unknown chemicals) has been urine and blood tested (prior to May 1995). The conclusion from these tests is that she has definitely been chemically exposed. Medical opinion is that she has around 10 years before developing cancer. She has had biological and neurological tests which show her immune system to be significantly compromised. She also has arsenic poisoning (Anonymous Londonderry Landholder 1995, pers. comm., 11 May).

She needs to take antioxidants, vitamins E and C [vitamin C has significant blood detoxifying

capacity (Davis, 1976:32)+, liver tablets, L-Cysteine and primrose oil (Anonymous Londonderry Landholder, 1995, pers. comm., 11 May).

The landholders first noticed problems with their animals in late ‘89 after heavy rains. Five horses became sick (they were found one morning lying down). One later died (Anonymous 1995, pers. comm., 11 May).

On 11 May, 1995, Murray’s (then agriculture) group spent 5 hours on the property testing the bore water and standing water in the paddocks. All the group members noted that they had developed sore throats by that evening. Murray and others of his group noted a ‘chemical’ odor in the air on the test day. This was contrary to a notable ‘bushy’ smell that was automatically expected, especially given the bush setting in which the property sits.

On the above date the landholder noted that it had been 12 months since her horses had experienced skin complaints and 2 years since their noses had hemorrhaged. It was postulated that this *might* indicate a change in the underground flow of contaminant emissions from the depot, possibly only a temporary reprieve. It was considered possible that the contaminants responsible for the horses’ problems had moved on. The overall impact of the chemicals is apparently very mercurial. The underlying geology may be changing progressively, ie. naturally, or even changing as a result of the chemicals’ presence and activity (Anonymous Londonderry Landholder. and Thompson, M. 1995, pers. comm., 11 May) [recall that Greenpeace said chemicals can *change* the permeability of clay (Earl, 1990:4)].

Physiological (1996) -- Human

On Sunday 1st September, 1996 myself and another group member (Steve) visited the property for bore water and soil sampling. Both students noticed a chemical smell in the air.

Steve received noticeable irritation/’burns’ on his hands after contacting wet soil. I felt somewhat compromised by the odor I was inhaling (nausea).

The landholder said she had developed asthma only in the last few months and that asthma

medication only made the asthma worse (Anonymous Londonderry Landholder 1996, pers. comm., 1 September) (She is in her early fifties?). I commented to her that this reaction is typical of chemical accumulation in the lung tissue. I said that the asthmatic (broncho-constrictive) response is designed specifically to expel irritating allergens/chemicals from the lung tissue [this is why some asthmatics die from an acute attack after, especially, taking only broncho-dilating medication (Sinclair 1993:41)+ via the transporting vehicle of mucus production and expulsion. In her case, the asthma medication succeeds only in increasing the chemical load within her lung tissues. Her asthma would probably disappear after a few month's removal from the property, away from the soil, the source of the outgassing chemicals causing her asthma. She agreed entirely with this diagnosis.

1996 Bore Water Tests

On the above occasion, we conducted further testing of the bore water on the landholder's property. The most notable result to come out of that testing was a surprisingly high and somewhat disturbing reading of 1.2084 ppm of cadmium.

GENERAL SYNTHESIS OF AVAILABLE INFORMATION

At this point, a synthesis of toxicological information is needed in order to determine if certain chemical exposures produce symptoms akin to those experienced by the Londonderry residents. This exercise might assist in highlighting potential (introduced) environmental causes for local health problems. Any contaminants indicated can then be checked to determine if they are among those deposited at the Castlereagh waste depot.

Recall that it was noted above that Auditors AGC Woodward-Clyde made public figures on severe phenolic and elevated organic carbon contamination of *groundwater under the Castlereagh depot* *which figures were not known to, or were perhaps conveniently 'overlooked' by, the Department of Water Resources]). Together with this, the *cadmium indications in groundwater* under the property and the landholder's *arsenic poisoning* may begin to paint a

picture of general contaminant potentialities regarding their subsurface transport to properties adjoining, or near to, the waste depot.

Health Implications of Heavy Metals Poisoning

The Thornton (1991:68) study appears to encapsulate a few contradictions, namely:

1 The household garden soils [in Britain] greatly exceeded the levels of cadmium in polluted paddy soils associated with the well-documented ‘itai-itai’ disease in Japan...

3 From studies of metals in locally grown vegetables and diets, an average uptake for human beings of 200 ug cadmium per week was calculated, compared with the average intake in the United Kingdom of 140 ug cadmium per week. Individual intakes rarely exceeded the World Health Organisation’s provisional tolerable weekly intake of 450 - 500 ug cadmium.

4 Health inventories and biochemical tests on 548 residents of Shipham and on 543 control subjects from a nearby uncontaminated village showed only slight differences attributable to cadmium (Thornton, 1991:68).

I would dispute the ‘safe’ levels given by WHO since the health inventories *did* find “differences attributable to cadmium”. Also, “Cd, Hg, and Pb, *have not been shown to be essential for either plants or animals*” (Jones & Jarvis, 1981:594) (emphasis mine) and, indeed, heavy metals are toxic “at quite low concentrations” (Cresser, Killham & Edwards, 1993:152, referencing Sauerbeck, 1987).

Cadmium in bore water just 5 meters from the surface is a genuine cause for concern, as is cadmium at 0.5 ppm (500 ppb or 500 ug/L) just below the surface (soil sample F), especially when it has been stated that “in fresh surface waters and most groundwaters, cadmium levels are generally less than 1ug/L” (WHO 1989:164).

Test Results. At this point, it should be noted that the EPA tested the bore water on the Anonymous Londonderry Landholder property in February 1996, and found formaldehyde, as

well as ‘low’ levels of heavy metals in soil tests. The landholder was diagnosed with a severe calcium deficiency 2 months ago (she has half the normal level of calcium in her body). Her doctor was absolutely shocked at this finding and is very concerned for her wellbeing. And this finding is despite the fact that the landholder was put on large doses of supplements two years ago when she was diagnosed as having arsenic and heavy metal poisoning (Anonymous Londonderry Landholder 1996, pers. comm., 11 September).

Cadmium Toxicity. The main symptoms to mention here, especially in reference to the immediately above (and also in relation to the more ‘invisible’ effects occurring on biochemical levels), are in terms of cadmium’s:

• implication “in bone deformations” (Rowland & Cooper, 1983:170),

• initiation of respiratory difficulties with high level exposure to fumes (Philp, 1995:141),

• long-term development of obstructive pulmonary disease and emphysema through chronic exposure (ibid)

• sufficient and limited evidence of carcinogenicity in animals and humans respectively (O’Neill & Dodet, 1985:5)

• impacts on membrane structure (Higham, Sadler & Scawen 1985:1475); “bonding to sulphydryl groups” and “inhibition of enzymes”

Following, in **TABLE 1**, are Food and Nutrition Board and WHO guidelines (O’Neill & Dodet 1985:10) for cadmium and lead ‘nutritional requirements’ (minima and maxima).

Element	Recommended[a] minimum intake (mg/day)	WHO[b] guideline maximum values for drinking water (ug/L) [ppb]	WHO estimated[b] from	Proportion absorbed
			Food and water (%)	Air (%)
Cd	-	5	6	64
Pb	-	50	10	40 overall

TABLE 1 ***Recommended Intake Minima and Maxima and Estimated Bioavailability of the Elements*** **(**Adapted from O’Neill & Dodet, 1985:10)

a Food and Nutrition Board (1980)

b WHO, 1984b

Given that the body has no requirement for Cd, that this heavy metal is implicated in so many morbid disease conditions, and that WHO substantiate the ‘alien’ nature of Cd by recommending a **nil** minimum daily intake (O’Neill & Dodet, 1985:10), it is therefore almost incomprehensible that WHO can even allow 5 ppb as a maximum level for this contaminant in water for human consumption!

And if anything higher than **5 ppb** Cd in drinking water is considered *unacceptable* by WHO, then what can we assume is the degree of toxicity for Cd on the landholder’s property when we recognize contaminant levels of **1,208.4 ppb** (1.2084 ppm) and **500ppb** (0.5 ppm) in bore water and soil , respectively?

Chemical Toxicity: General Impact On Human Health

Xenobiotics

Xenobiotics are foreign chemicals (Vayda 1991:60). This author links toxic chemicals to Chronic Fatigue Syndrome or CFS. Vayda introduces this vital concept:

I cannot understand how anyone can fail to appreciate that adding many thousands of NEW toxic chemicals to our environment for years on end (at least for the last forty years) is going to affect the health of human beings. Especially since these chemicals are used to kill animal cells, to strip protective coating from enzymes, to use up precious, and often scarce, reserves of essential minerals, enzymes, vitamins and amino acids (Vayda 1991:60-61).

Exposure to Chemicals in Daily Life

The use of chemicals today is extremely widespread. From home to car to workplace and back gain, chemicals can be found incorporated into almost any product used or food article consumed. Chemicals are part of our environment, both through the modern materials that we

use, and through the less fortuitous release of toxic substances into the air we breathe and the soil from which we draw our ultimate sustenance. Note the following:

> The best environment for the inhalant prone person is a wood-paneled house with tiled floors, only a few woolen rugs and cotton curtains. [In contrast to these natural substances]... Nylon and plastic products tend to give off a hydrocarbon vapour (formaldehyde) when in a warm environment.
>
> Constant exposure to such a chemical-laden environment greatly taxes both the immune system and the enzyme chains of the liver, as they strive unceasingly to break these chemicals down to less toxic products (Alexander 1990:90-91).

Which Chemicals?

We normally associate chemical poisoning with obvious illness or even death. However, chemical poisoning and chemical sensitivity can occur on a subliminal level, and one can ingest, inhale, or absorb toxins within the context of an assumed safe environment. Note these shocking details:

> Chlorine is the second most common chemical [after formaldehyde] and is found in drinking water, washing water, swimming pools, bleaches, anaesthetics and many drugs. It is used in the refining of both cooking oils and sugar. In its free state chlorine is a deadly poisonous gas. It readily binds with other chemicals to form compounds.
>
> It must be remembered that many of the chemicals found in the home, work environment and agricultural sprays are also found as chemical colourings, flavourings and preservatives in food.
>
> Take formaldehyde, for instance. It is the most common chemical in the average

household. It has little odour but is the component of car fumes, smog and natural gas combustion (home heaters and stoves) that causes *burning of the eyes*. Formaldehyde is found in concrete, plaster, home insulation materials, home antiseptics, toothpaste, disinfectants, waxes, polishes, adhesives, fire proofing compounds applied to fabrics, foods, insect repellents, nail polish, wall boards and resins. It is a by-product of the processes that make natural and synthetic fabrics crease-resistant, dye-fast, shrink-proof and more elastic... It constitutes a major portion of the pollutants in the air that now cover the earth (Alexander 1990:91-92).

The Effects of Toxic Chemical Exposure

Many of the modern diseases now reaching epidemic proportions are attributable to exposure to xenobiotics. The symptoms have a very wide range, and evidence now confirms that many illnesses, once considered the domain of pathology and psychiatry are not ultimately caused by pathogens, hormone imbalances and ‘unknown causes’. They are generated through the presence and accumulation of chemicals which weaken the body’s defenses and so thus make possible the entrance of bacteria, viruses and negative environmental influences. Note these symptoms:

Not only can food and chemical sensitivities cause eczema, asthma, hayfever, migraines and abdominal pains, but they can also produce subtle changes in the functioning of the nervous system, the immune system and eventually every tissue and organ within the body (Brighthope & Fitzgerald 1989:52).

Vayda adds:

Because the mitochondria are essential for providing energy to cells, and therefore to every system in the body, a reduction in the function of some of their enzymes leads to an impairment of cellular respiration. Cells, like us, cannot perform efficiently without a form of ‘breathing’ and when this is damaged they wind down. Groups of tissues

follow and eventually organs or systems join the list (Vayda 1991:61).

Today, quality of life is much reduced through the impact of a multitude of disease conditions that are not readily categorized:

The nervous system is particularly sensitive to food and chemicals. The effects on the nervous system include the aggravation of virtually all psychiatric disorders and psychological symptoms. Symptoms include tension, anxiety, depression, fatigue, mood swings, irritability, weakness, lethargy, crying spells, phobias, irrational fears, visual disturbances, headaches and migraines (Brighthope & Fitzgerald 1989:52).

These symptoms are produced through, more often, the subtle impact of chemicals:

Every chemical added to our environment tends to increase the amount of free radicals generated and decrease the body's ability to detoxify. We all know some of these chemicals are bad because they may cause cancer or affect foetuses. What some people do not realise is that, in far more subtle ways, they may contribute to an acceleration of the ageing process and the promotion of a variety of degenerative diseases by slowly impairing our immune system. Viral diseases, candida, and a host of other illnesses are caused by OPPORTUNISTIC organisms and only occur when our resistance is compromised. Even low-grade, chronic exposure to chemicals can render one more susceptible to allergies, biochemical aberrations and immune disorders such as arthritis (Vayda 1991:61).

Toxic Chemicals at Castlereagh and Exposure Symptoms

The above certainly indicates that industrial chemicals are widely applied. The inference is that these are the types of *chemical wastes* buried at Castlereagh (and it should not be neglected that these chemicals are also present in our homes; this is a possible 'scape-goat' for many defending the waste depot). This is supported by Exhibit H in the Metropolitan Waste Disposal Authority's Environmental Impact Statement: *Proposed Short Term Extension, Castlereagh*

Regional Liquid Waste Disposal Depot report of July 1977 (see **Appendix 6 *Lists of Chemical Wastes***), which lists the following chemical categories in the then Application for a Licence to Transport Waste for Fee or Reward which was to be allied with another form entitled: Application for Approval to Use the MWDA's Regional Liquid Waste Depot for the Deposit of Liquid Waste:

• Paints (acryl, alkyd or vinyl based, printing inks)

• Resins (phenolic, alkyd or vinyl base)

• Solvents (chlorinated -- trichloroethylene, non-chlorinated -- benzene, alcohols, esters, ketones)

• Oils (waste oils *lubricating, hydraulic, mineral+, oil sludges, vegetable oils)

• Emulsions (rubber latex, butiminous based)

• Organic wastes (animal waste, bacterial sludge, vegetable wastes)

• Other organic chemicals (chlorinated -- DDT, chlorobenzene; non-chlorinated -- xanthates, alkyl sulfonates)

• Acidic wastes (sulphuric and others, nitric and others, phosphoric, chromic, hydrochloric, other acid wastes)

• Alkali wastes (caustic soda, lime cement slurries)

• Neutral salts (chrome, iron, ammonium and various metal salts, not acidic or alkaline)

• Plating wastes (cyanide wastes, other plating wastes not included in any other category)

• Other inorganic chemicals (Metropolitan Waste Disposal Authority, 1977).

Please note that the *solvents* and *other organic chemicals* categories above list benzene and chlorobenzene. Benzene "must be handled carefully because it is toxic. Not only is it poisonous if ingested in the liquid form, but the vapor form is also toxic and can be absorbed either by breathing or through the skin. Long-term inhalation can cause liver damage and cancer" (Bettelheim & March, 1995:344).

SUBSTANCE	EFFECTS
Metals Lead	Fatigue, insomnia, headache, loss of appetite, constipation. Increased exposure: abdominal cramps, severe constipation, weakening of muscles due to disturbance of peripheral nervous system.
Cadmium	Nausea, vomiting, diarrhoea, muscular cramp, kidney failure following oral ingestion, lung irritation, chest pain; implicated in bone deformations and as a carcinogen (prostate gland).
Mercury	Nervous system -- tremor, psychological withdrawal, irritability.
Zinc	'Metal fume fever' from inhalation of fumes with symptoms similar to influenza.
Inorganic chemicals Arsenic	Irritant to mucous membranes and eyes, highly toxic on ingestion --nervous symptoms and degeneration of liver; carcinogenic.
Carbon disulphide	Toxic to central nervous system and may lead to respiratory failure.
Organic chemicals/hydrocarbons Benzene	Chromosome aberrations possible above 25 ppm; repeated exposure above 50 ppm causes reduction in red blood cells, and chronic exposure may lead to leukaemia. Narcotizing agent.
Xylene	Moderately toxic to blood, liver and kidneys. Narcotizing agent.
Styrene	Irritant to skin, mucous membranes.
Toluene	Mucous membrane and skin irritant.
Organophosporous compounds	Lowering of blood cholinesterase (vital to nerve cells), pains and defective circulation in extremities; paralysis of limb muscles.
Phosgene	Serious respiratory system damage.
2,4,5-T	Highly toxic and readily absorbed by inhalation/ingestion. Weakness, diarrhoea, loss of appetite, cardiac arrest, death. Reputed teratogen and carcinogen.
Gases Nitrous oxide	Possible cause of abortions in operating theatre personnel.
Hydrogen cyanide	Extremely poisonous: affects enzymes and so limits oxygen availability.
Nickel carbonyl	Irritation of respiratory tract, headache, chest pains, weakness, cyanosis. Possible carcinogen.
Hydrogen sulphide	Nausea, irritation of respiratory system and eyes; possible nervous system disorders.
Chlorine	Highly irritant; can induce permanent reduction in lung function.
Ammonia	Irritant to eyes, nose, throat and skin.
Sulphur dioxide	Irritant to eyes, nose and throat to a great degree.
Nitrogen dioxide	Irritation of upper respiratory tract; chronic bronchitis from long-term exposure.
Formaldehyde	Respiratory irritant, skin irritant and allergen. Suspected carcinogen.
Acids Sulphuric acid	Respiratory risk; hazard to skin and eyes.
Nitric acid	"
Hydrochloric acid	"
Hydroflouric acid	Tissue destruction. Highly irritant to mucous membranes.
Alkalis	Caustic to skin, flesh and eyes; injurious to entire respiratory tract.

Further to the above, also note **Appendix 6 ITEM 4** ***Listing of All Non-LWP Wastes Received at the Castlereagh WMC From April 1990 to Date***. Now note, in **TABLE 2** ***Hazardous Chemicals and Exposure Symptoms***, the following extensive list of chemical poisoning symptoms (overpage):

TABLE 2 ***Hazardous Chemicals and Exposure Symptoms***

Sodium hydroxide	
Potassium hydroxide	"
Potassium carbonate	"
Aldehydes Acetaldehyde	Irritant action on mucous membranes.
Metaldehyde	"
Benzaldehyde	"
Ketones	Irritant action on eyes and respiratory system. Potential cause of dermatitis.
Other substances Toluene diisocyanate	Irritant which may precipitate asthma. Long exposure may cause dermatitis.
Phenols	Dermatitis.
Cresols	"
(Adapted from Rowland & Cooper 1983:169-177)	

Chemical Toxicity: ADI Limited Report Shows Leakage Outside Toxic Depot

The ADI Limited Half Yearly (to June 1997) Report on the groundwater monitoring program at the Castlereagh Waste Depot clearly showed at the time that the depot was overtly leaking toxic chemical waste. Wells (from which bore water samples can be extracted) along the perimeter of the depot, along with wells located more than half a kilometer outside the depot indicated a disturbing array of toxic contaminants.

Which Contaminants and Where?

Several organic compounds have been found in Well 943a, which is located on the south-west perimeter of the waste depot, on Llandilo Road, and just over the road from Fifth Rd in Berkshire Park (see Figure 1 in the first ebook listed above). Volume I of the ADI Report specifically notes

that Well 943a “contained several organic compounds similar to those found in onsite wells” (ADI Limited 1997a:52).

Volatile halogenated compounds (VHCs) (including 1,1–dichloroethane, chloroform, methylene chloride [dichloromethane] and trichloroethene), total petroleum hydrocarbons (TPH) (ADI Limited 1997a:20; 1997b:Appendix B), and the semivolatile organic isophorone (detected before January 1997 [ADI Limited 1997b:Appendix B]) were found.

Toluene, methyl ethyl ketone, and methyl isobutyl ketone (ADI Limited 1997a:20-21) are listed among the contaminants found in groundwater at this 943a well site.

The story of chemical leakage continues with Wells 942C, located just inside the north-east perimeter, and 941 (on the perimeter, south of the John Morony Correctional Centre). 942C showed “moderate concentrations” of TPHs (0.856 mg/L) and “low concentration*s+ of formaldehyde” (1.3 mg/L). 941 also demonstrated the presence of TPHs in the groundwater, including toluene (ADI Limited 1997a:22). It is important to note here that the ADI Report often notes that contaminants were not detected before this test period. This clearly shows contaminant movement. However, the obvious source of these toxic wastes “can not be established with certainty”, according to these 'experts'. Proposed theoretical sources are given as “a local source or cross contamination of the wells during drilling and installation” (ADI Limited 1997a:22). That a waste depot hopefully containing and witholding 2 million tonnes of 'stored' waste -- and one located right where the test holes are -- does not feature in ADI's theory is interesting...

With wastes indicated along two sides of the depot, we should then ask if chemicals are indicated as leaking beyond the perimeter. Yes they are. The south and the western perimeters have offsite bores that clearly contain indicators of toxic chemical wastes.

First, Well 317A, located on the southern perimeter shows upward trends in the chlorinated hydrocarbons 1,1–dichloroethane and -ethene, cis–1,2– dichloroethene and trichloroethene

(ADI Limited 1997a:42).

Next, Wells 904, 905, 906, 969 and OSMB5, located from 200 to 500 meters outside this perimeter, have varying indications of the following chemicals: chloroform, trichloroflouromethane and vinyl chloride. What are these chemicals doing outside the depot in the groundwater? Probably the same as the TPHs, toluene and VHCs in the perimeter wells 941 and 943A: migrating!

Well OSMB2, located offsite and across The Northern Road from the depot, indicates 0.083 mg/L of TPHs in June 1997 (ADI Limited 1997a:Table 12F-1), along with traces of arsenic, cobalt, phenol, di-n-butylpthalate, and butylbenzylpthalate (ADI Limited 1997a:Table 12F-2).

Upgradients, 'perched groundwaters' and chemical diffusion

It was noted in the Report that Wells 905 and OSMB5 are "located upgradient to the WMC…" (ADI Limited 1997a:27). The wording implies that the chloroform in groundwater in these two wells could not be sourced from the depot. Further to this, the presence of the chloroform, as with other chemicals found in wells along the depot perimeter, is considered to represent an "anomaly" (ADI Limited 1997a:27). An anomaly is what you call a situation when you don't want to call it what it really is: chemical leakage from a source containing "one million tonnes of liquid waste... dumped at Castlereagh over the past 20 years" (Kerr, 1995:3).

Perched groundwaters: this term has developed a mythical quality over the past few years with regard to Waste Service NSW (WSNSW) and other authorities' usage of it. It is a term that magically 'explains', without ever providing rational and physical proof, why the groundwaters beneath the depot are somehow totally isolated from all other groundwaters outside the depot. According to WSNSW theory, chemicals cannot cross this mysterious barrier and escape into groundwaters adjacent to the depot.

Modern research into landfill technology, however, contradicts ADI 'upgradient' insinuations and exotic perched groundwater theories. Note:

The objective of controlling the hydraulic conductivity is clearly one of limiting advective contaminant transport (ie the movement of contaminants with moving water) through the liner. However, despite more than a decade of research and the existence of good supporting field data, it is only recently that it has been generally recognized that there is a second contaminant transport process which will occur even through a very low hydraulic conductivity clay liner: that process is chemical diffusion. ...diffusion may be the dominant contaminant transport mechanism in a well-constructed clay liner. Furthermore, contaminants can escape from a waste disposal site, by diffusion through a liner, even if water flow in the liner is into the landfill (Rowe,1994:219) (emphasis added).

When one adds an EPA admission of chemical leakage offsite by way of groundwater contamination (EPA Official 1995, Community Monitoring Committee Adress, 26 April [recorded at the Community Monitoring Committee meeting at the Penrith City Council Chambers – see Appendix 4 at the above-noted website's Free eBooks/Global Toxicity menu item]) to the above scientific research, it becomes all too clear that the waste depot was leaking a broad range of toxic contaminants onto the surrounding agricultural lands.

How Toxic Are These Chemicals?

Various studies have been accessed for this section in order to determine the toxicities of some Well and property chemicals. Some overlap will occur here with information contained in **TABLE 2** ***Hazardous Chemicals and Exposure Symptoms*** on pages 21-22.

Cadmium, and other heavy metals are toxic “at quite low concentrations” (Cresser, Killham & Edwards 1993:152). Cadmium is implicated “in bone deformations” (Rowland & Cooper 1983:170), the longterm development of obstructive pulmonary disease and emphysema (Philp 1995:141), carcenogenicity in animals and humans (O’Neill & Dodet 1985:10), and nephrotoxicity (WHO 1989:168).

Vinyl chloride (Wells 904, 905, 906, 969 and OSMB5) causes liver, brain, lung and lymphoid tissue cancer (Siemiatycki 1995:103-104) and is a skin irritant (Rowland & Cooper 1983:176). It also induces tumors of the blood in the occupationally exposed and is a suspected *mutagen* (Alloway & Ayres 1993:216).

Chloroform (four of the above Wells) is implicated in cancer (Philp 1995:81; Alloway & Ayers 1993:216) and hepato- (liver) and nephro- (kidneys) toxicity (Philp 1995:152).

Toluene (Wells 941 and 943A), an organic solvent, is a mucous membrane and skin irritant (Rowland & Cooper 1983:174). More disturbingly, toluene is described as “a neurotoxin which is absorbed through the lungs…” In this respect, “it can induce mild abnormalities of the CNS… *and+ death due to its inhalation has occurred as a result of solvent abuse… (Alloway & Ayres 1993:44;216). Methyl ethyl ketone (Well 943A) can cause dermatitis and has an “irritant action on the eyes and respiratory system” (Rowland & Cooper 1983:175).

Formaldehyde (Well 942C) is a respiratory irritant and a suspected carcinogen (Rowland & Cooper 1983:173).

Arsenic (Well OSMB2) causes liver and lung cancer (Rowland & Cooper 1983:58), as well as skin cancer (Sunderman 1985:17).

Phenol (Well OSMB2) is corrosive and poisonous (Aviado 1976:1068) and “can cause vomiting,

eye and respiratory problems…" (Bender 1991). Further, phenol causes changes to enzymes within the endoplasmic reticulum (in cells), particularly in the liver, but also the kidneys, lungs and intestines (Alloway & Ayers 1993:210).

Chlorinated hydrocarbons (Well 317A) promote allergic reactions such as dermatitis and are also narcotizing agents (Rowland & Cooper 1983:176-7). These very persistent contaminants have a high potential for human toxicity indicated by "reproductive defects in phytoplankton and, in mammals and birds, microsomal enzyme induction [a modification imposed on germ cells (Kellogg 1976:702)+, tumor promotion, estrogenic effects and immunosuppression" (Philp 1995:77).

Trichloroethene (Wells 317A and 943A) is an organic solvent that promotes dermatitis and has narcotizing effects (Rowland & Cooper 1983:176-7). It should be noted here that 1,1,1-trichloroeth *ane* has produced deaths in acute occupational exposure and heart failure through solvent abuse (Alloway & Ayres 1993:217). Well 317A shows increasing levels of the 1,1–dichloroethane isomer which "is considered to be 33 times more hazardous than the 1,2 isomer" (Alloway & Ayres 1993:57).

Dichloromethane (Well 943A) converts to carbon monoxide "which forms carboxyhemoglobin in the red blood cells" (Philp 1995:153), thus reducing oxygenation and impairing respiration. Oxygen deprivation is a major problem in coronary insufficiency and, where heart attack occurs, leads to a greater destruction of heart tissue in those who survive and, otherwise, a more pronounced fatality rate (Davis 1965:58).

It must be pointed out here that residents around the Castlereagh Waste Depot can be exposed to fumes and liquid leachates 24 hours a day, this being a far more critical situation than monitored *occupational* exposure. **It is no wonder, then, that teratogenic impacts on livestock *and humans* have been noted by the landholders on a disturbingly regular basis.**

Chemicals and Symptoms

The above-listed convergence of chemical analytes found in test wells on the perimeter and outside the Castlereagh Waste Depot and symptomatology, synchronize with the illnesses experienced by Londonderry residents living close to the depot, as the next section shows.

Chemical Toxicity: Xenobiotic Poisoning Of Londonderry Landholders

We have noted that chemicals can escape through clay liners and that the EPA has admitted to such liner failure and subsequent groundwater contamination. We have also seen that genetic mutations, disease and abnormal *animal* deaths (in particular) and behavior have been commonly reported by landholders in the dump area.

Most of the affected landholders in Londonderry are located between the waste dump and the Nepean River, so it is, therefore, not surprising to find that, "Results taken from the river [Nepean, which is immediately to the west, and *below*, the waste dump] showed that the level of phenol -- a substance which can cause vomiting, eye and respiratory problems -- was double the acceptable amount" (Bender 1991).

In examining the *limited* range of data permitted to be documented by the Human Health Study, and adding the results of the ADI Limited (1997) report above, we can clearly determine that there is an obvious and significant level of overlap between the disease symptoms expressed by the Londonderry landholders and those produced through exposure to chemicals which are toxic to humans. The landholder symptoms noted by the Human Health Study are:

The most common symptom was *headache*, while others included *rashes*, *skin burns*, *vomiting*, *nausea*, *diarrhoea*, *fatigue*, *sore throats*, *shortness of breath*, *runny nose*, *dizziness*, *eye irritation*, *itchy skin* and *stomach pain* (Kerr 1995:3) (emphasis mine).

And let us not neglect the "increased incidence of brain, breast and uterine *cancers*" (Kerr 1995:3) (emphasis mine).

Every landholder symptom noted above is covered by the effects produced through exposure to chemicals. Our student sampling and tests (in 1996) have determined unusually high levels of toxic and carcinogenic **cadmium** (*which does not correlate with organic matter levels in the*

property soils, as would be the case if the metal was a natural geological resident), along with (in 1995) extremely high levels of salinity, and unusually high levels of soluble low-range phosphorus in the bore water on the landholder's property. Remember, the property is just *2 kilometers from the waste depot* and situated in a "locality of special concern" (Total Environment Centre Inc 1996:25) where the following human health and environmental symptoms and geological features have been noted:

Severe irritation of skin on contact with water or wet ground Black oily substance or black sludge seeping out of ground Red scum on creek or dam water

Extensive crop deaths when irrigated from creek or dam

Rickabys Creek gravel outcrops at surface (Total Environment Centre Inc 1996:25)

On two occasions, in visiting the property for purposes of testing, those students involved have received injuries (skin burns, nausea and sore throats) from coming into contact with the property soils/water and through breathing the noticeably chemically-laden air.

GENERAL SYNTHESIS OF LABORATORY RESULTS

Laboratory And Post-Field Results Summary For All Tests (1995/96)

Overpage, a summary of soil/water test results on the property for test sessions during 1995 and 1996 is listed in **TABLE 3** ***Detailed Results -- 1995 & 1996 Tests Combined***.

O. M. (H_2O_2 test)				2 "	1 "	5 "	3 "
O. M. (g/g)				0.0414	0.0189	0.0338	0.0195
(%)				3.97	1.85	3.27	1.91
Organic Carbon (%)				2.26	1.06	1.86	1.09
Salinity (g/L NaCl)	15.7	39.5					
Soluble Low P (ppm)	28	12.1					
High Total P (ppm)	10	Nil					
Aluminium	Nil	Nil					

KEY: A = Soil sample at site A
B = Soil sample at site B
C = Soil sample at site C
F = Composite soil sample at site(s) F (see property map in Appendix 2)
* = Mean value of 5 duplicates
# = Mean value of 2 duplicates
** = Mean value of original and 1 replicate
" = Hydrogen peroxide test: 0 = no bubbling (nil O_2 evolved); 5 = intense bubbling (O_2 vigorously evolved)

MATERIAL / TEST	1995 Surface H_2O	1995 Bore H_2O	1996 Bore H_2O	1996 Soil Samples A	B	C	F
Temp (C)			15.4 (3 hrs after removal @ 8.42pm)				
pH (Hach) meter			6.86 @ 15.5 C				
pH (Raupac / $BaCl_2$)	8.49	7.6		9.0	5.0	>9.0	5.0-5.5
pH (0.5 M $CaCl_2$)				6.61	4.57	8.01	6.42
EC (mS/m)	2.54	19.04	16.97				
(ppm [EC X 670])	1701.8	12756.8	11369.9				
TDS (g/L)	1.27	9.52	8.47				
Soil EC (mS/cm)				0.07	0.03	1.06	0.11
Texture				silty clay loam	sandy clay loam	Mixture: sandy clay loam / loamy sand	loamy sand
Factor				9	10	10 / 12	12
Cadmium (ppm)			1.2084 *	Nil #	Nil **	Nil **	0.5 **
Lead (ppm)			0.0108 *	13.5 #	11 **	6 **	6 **
Copper (ppm)			0.036 *	8 #	1 **	2 **	Nil **
Chloride				Nil	Nil	Nil	Nil
Lime				Nil	Nil	Nil	Nil
Soil Moisture (g/g)				0.2295	0.1406	0.1574	0.1101
(%)				18.64	12.33	13.59	10.43

TABLE 3 ***Detailed Results -- 1995 & 1996 Tests Combined***

MATERIAL / TEST	1996 Bore H_2O	1996 Soil Samples A	B	C	F
Cadmium (ppm)	1.2084 *	Nil #	Nil **	Nil **	0.5 **
Lead (ppm)	0.0108 *	13.5 #	11 **	6 **	6 **
Copper (ppm)	0.036 *	8 #	1 **	2 **	Nil **
O.M. (%)		3.97	1.85	3.27	1.91

In brief, there appears to be a definite relationship between O.M. content and soil moisture. Site A, with the highest O.M. reading of 3.97% had the highest soil moisture (18.64%). Site B -- 1.85%:12.33% O.M. and soil moisture respectively; site C, a higher (than site B) 3.27%:13.59% ratio, and site F -- a lower 1.91%:10.43% ratio.

The vegetation on site also related to O.M. content. Site A was very grassy, with high (3.97%) O.M. (although some of this O.M. might be due to horse manure having been deposited in the grass near the sample area); site B had only short grass and was basically an undisturbed bush scrub environment with a lower O.M. level; site C had a higher (than site B) O.M. level again, but this may be solely due to horse feces, as this site was a used horse paddock. Site F was similar to site B in that it was a grassed area under trees, however this area was on the property and had been disturbed at some time in the past.

O.M. also related to soil pH. As grass related to higher O.M. levels, the O. M. levels were also followed by the pH values, ie. the higher the O.M. level, the higher or more basic the pH.

Again, soil EC followed this pattern almost precisely. Where O.M. and pH rose, so did the soil EC. The reverse of this also applied closely.

None of this data appears to relate, at least superficially, to the issue of waste contamination.

TABLE 4.1 ***Specific Results for Property Water and Soils*** **Shows cadmium, lead and copper levels detected in the Anonymous Londonderry Landholder property bore water and soils (1996)**

Comparisons

TABLE 4.1, above, shows a fairly consistent relationship between O.M. levels (%) and heavy metals levels in regard to copper moreso and lead less so. This may be because, "colloidal organic matter has a strong affinity for heavy metal cations, and the retention of added metals is often well correlated with the amount of soil organic matter" (Thornton, 1991:603, referencing Hodgson, 1963). See below under *Lead* in **TABLES 4.2 – 4.4**.

Recall, on page 25, that I noted there is no correlation between OM levels in property soils and Cd levels. The unusual level of 0.5 ppm Cd in Soil F is all the more starkly contrasted, therefore, against the levels of Cu and Pb which do show a reasonable correlation.

		SOIL		
METAL	LITHOSPHERE	TYPICAL	RANGE	PLANTS
Cd	0.2	0.06	0.01 - 0.7	0.2 - 0.8
Pb	16	10	2 - 200	0.1 - 10
Cu	70	20	2 - 200	4 - 15

Typical normal range in soil (ppm)		Metal-rich soils (ppm)	Sources	Possible effects
Cd	< 1 - 2	up to 30 up to 20	Mineralization Carboniferous black shale	Excess in food crops
Pb	10 - 150	1% or more	Mineralization	Toxicity in livestock; excess in foodstuffs
Cu	2 - 60	up to 2000	Mineralization	Toxicity in cereal crops

	Earth's crust	Igneous rocks			Sedimentary rocks		
		Ultra-mafic*	Mafic*	Granitic	Limestone	Sandstone	Shales*
Cd	0.1	0.12	0.13	0.09	0.028	0.05	0.22 (< 240)
Pb	14	14	3	24	5.7	10	23
Cu	50	42	90	13	5.5	30	39

TABLE 4.2 ***Concentrations of Heavy Metals (ug g-1 [ppm] dry matter)***

in the Lithosphere, Soils & Plants **Shows lithosphere and plant ranges for cadmium, lead and copper** (Adapted from: Jones & Jarvis, 1981:595)

TABLE 4.3 ***Metals in Soils Derived From Normal and Geochemically Anomalous Parent Materials in Britain*** **Shows normal and metal-rich ranges for cadmium, lead and copper, as well as sources and possible effects** (Adapted from Thornton 1991:53)

TABLE 4.4 ***Mean Heavy Metal Contents of Major Rock Types (ug/g or ppm)*** **Shows mean heavy metal levels for cadmium, lead and copper in igneous and sedimentary rocks** (Adapted from Alloway 1990:31, who bases this information mainly on Krauskopf [1967] and Rose *et al.* [1979])

Ultramafic rocks are also called ‘ultrabasic’, e.g. dunite, peridotite and serpentinite, Mafic rocks are also called ‘basic igneous rocks’, e.g. basalt. ‘Shales’ also include clays” (Alloway 1990:31).

Comparisons & Calculated Results

The above **TABLE 4.2** levels are drawn from Jones and Jarvis (1981:594) wherein these heavy metals levels are prefaced with the assertion that “heavy metals are present in all *uncontaminated* soils as the result of weathering from their parent materials” (emphasis mine). If these figures are reliable, then the property *soil* samples do not contain abnormal levels of heavy metal contaminants.

Cadmium. However, the surprising result may well be the *bore water levels of Cd*. Looking at **TABLE 4.2**, we can see that the uncontaminated level for Cd is 0.2 ug g-1 (ppm) in the lithosphere (rocky crust). Also, the typical level for soil is 0.06 ppm.

Our results show the Cd level in the property bore water, at 1.2084 ppm (1,208.4 ppb), to exceed the normal lithosphere level by 604.2%, and (for the sake of an initial comparison) the ‘normal’ soil level by 2014%. Nevertheless, the range allows for 0.7 ppm (0.8 ppm in Alloway & Ayers 1993:158) and the property soil F falls within this range. However, Alloway & Ayers (1993:158)

*detail the GWDisTV (groundwater dissolved content target value [from 1991 Environmental Quality Standards for Soils and Waters+ from "guide values and quality standards used in The Netherlands for assessing soil and water contamination by heavy metals" *referenced as: Netherlands Ministry of Housing, Physical Planning and Environment, 1991]) for cadmium in groundwater as being 1.5 ug/L or ppb.* ***In this case, the property bore cadmium level of 1,208.4 ppb is 805 times or 80,560% over this reference level!*** The Pb and Cu levels in the bore water do not mimic these higher levels. They could be considered normal or even below normal, if lithosphere and soil levels relate effectively to bore water levels. I see the potential for normal bore water levels to relate strongly to normal lithosphere levels in particular, as bore water represents the groundwater that serves as an integral moving component of the lithosphere.

A complication to the above conclusions could be seen in **TABLE 4.3**, which provides an entirely different set of heavy metals levels for *soils*. These soil levels would place the property bore water level of Cd within the normal range. Thornton (1991:53) allows up to 30 ppm Cd in "soils derived from... geochemically anomalous parent materials in Britain", and < 1 - 2 ppm in normal soils. Also, although Fossett (1980:71) states that, "cadmium is a rare element... averaging only 0.2 ppm", he notes that its concentration "is much higher in shales, especially those with high organic content, where it may average 2.0 ppm". The Londonderry area is "underlaid by Bringelly shale in excess of 100 metres in thickness" (Metropolitan Waste Disposal Authority, 1977). The shale *may* be the origin of local cadmium levels, however Alloway (1990:31) supports a figure of 0.22 ug/g or ppm (thus agreeing with the figures in **TABLE 4.2** [Jones & Jarvis, 1981:594]) even in shales. These correlations appear to highlight an abnormal level of Cd in the bore water. In other words, the Cd bore water concentration may be far too high, *even for shale-based soils*.

The 1.2084 ppm Cd in the bore water may well be anomalous, and of suspect origin because, in

addition to the above, Cd contamination in England has been reported (Thornton, 1991:64-66) mostly in terms of old mine workings (for Cd in soil). There is no mining activity in the Londonderry area, nor is there any consistent indication of “fumes and dusts containing metals which are transported in the air and eventually deposited onto soils and vegetation” (Alloway, 1990:34). This is because Cd is not indicated in most of the soils we tested.

So we might need, therefore, to pose the question: where does the Cd originate, *if it is not a natural geochemical/groundwater feature due to its anomalously high concentration*? Perhaps Alloway (1990:34) can again help by defining a potential origin and transport mechanism for the Cd in the bore water: “... **by the creation of waste dumps (and scrap yards) from which metals may be leached and thus pollute underlying or nearby soils**” (emphasis mine).

Cadmium Correlations. At this point in our investigation of Cd, we need to bring in further research in order to attempt to break the deadlock noted above. We need to define a substantiated trend in normal Cd concentrations in order to see more clearly what abnormal (waste-induced) concentrations are like. For this, we refer to Christensen (1980:41):

The distribution of cadmium in unpolluted soils (i.e. no waste applied) may yield information on the soil parameters possibly governing the sorption of cadmium from dilute waste leachates. Such investigations have been conducted in a few cases but unfortunately they do not exhibit a general pattern with respect to cadmium. The major findings of these investigations are summarized in the following paragraphs.

Keilen, et al. (1978) investigated the trace metal distribution in several German soils. *Extractable cadmium (0.01 M NH4OH) was positively correlated to carbon content...*

The authors pointed out that the correlation between cadmium and organic matter may not be a casualty: organic matter is concentrated in the top soil due to the plant productivity *and cadmium being a man caused pollutant of relatively recent origin (aerial deposition, fertilizers) is still found in the top soil as well.*

Tjell & Hovmand (1978)... No correlation was found with humus contents.

Gong, et al. (1977) determined the cadmium content in stream sediments (0.05 - 0.4 ug Cd/g) and found correlation with organic matter and manganese oxides (Christensen, 1980:41-43) (emphasis mine).

In 3 out of 5 testing instances quoted above, there was found a positive correlation between Cd and O.M., with a fourth being specifically recorded as a positive correlation between Cd and carbon content. Only one instance was noted as a negative for humus/Cd correlation. Also, Cd was seen as being negatively correlated to clay.

These results are important because they appear to indicate that we should not expect to find aerially or agriculturally deposited Cd associated with clay. We should, however, expect a positive correlation of Cd with humus. So to the Anonymous Londonderry Landholder property, and what do we find? We see *no consistent correlation between Cd and humus*. Of the 4 soils tested, only soil F has Cd, and this soil has the second lowest O.M. content. If aerial/agricultural deposition of Cd is the source of soil F and bore water Cd on this property, then soils A and C, with the highest levels of O.M., should have at least registered some Cd. They did not. Rather, the high Cd level in the bore water is ***indicative of an underground origin for the Cd***. The complete lack of a consistent spread of Cd on the surface demands that the only immediately obvious sources of Cd are the Bringelly Shale or the Rickabys Creek gravel which could be transporting Cd from the Castlereagh Waste Depot, only about 2 km from the property. Given that Cd is on the property, how might it have spread if its source is below-ground and if *springs* (Anonymous Londonderry Landholder. 1996, pers. comm., 11 September) are particularly active after rains?

At this point, we can now relate, at least in part, the Cd to past water flow on the property. Please now refer to **Appendices 2a *Depot Environs Map and Locations of Reports of Groundwater Pollution*** (Total Environment Centre, Inc. 1996:25), and **2b *Anonymous Property***

Soil/Water Test Map and Anonymous Property Photos. The water table is very close to the surface, particularly in the western portion and along the southern border of the property. For example, there is an almost permanent puddle of surface water in paddock 3 (P3) (Anonymous Londonderry Landholder 1996, pers. comm., 11 September). The soil sample Site A revealed a >25 cm sub-surface vault of almost clear water. The long, black arrows show the path of water after rains wherein subsurface water appears near the bore and traverses the property obliquely (Anonymous Londonderry Landholder 1996, pers. comm., 11 September), eventually heading north to north-east. The dashed blue line shows the possible perimeter of the surface intersection of the water table. (It should be noted that a lot of runoff comes from Timothy road and through the paddock immediately to the south [Anonymous Londonderry Landholder 1996, pers. comm., 12 September] of the Anonymous property.

The bubbling spring water which appears near the bore after rain, plus a perennially-filled well just west of P3, along with the continually wet ground or standing water in P3, seem to indicate a near waterlogged condition). The wide red arrow shows a dramatic floodway produced from September 1989 through to July 1990 when a 1 in 50 or 1 in 100 year flood occurred (Anonymous Londonderry Landholder 1996, pers. comm., 12 September).

It is proposed that the 0.5 ppm Cd in the composite soil samples F is a remnant of the 1989/90 flood. Now, working backward, we can investigate a possible cause of Cd contamination through observing the support research gives to Cd migration through soils.

Cadmium Migration. Cadmium can migrate into soils and groundwater beneath waste sites.

Note:

Of the investigations considering only the cadmium content of soil water or ground water... El-Bassam & Tietjen (1977) found 20-40 percent increase in the cadmium content of soil solutes 1-2 m below land receiving 4-15 tons of sludge solids per ha.

The groundwater at 8 m depth was affected as well (23 ug Cd/l compared to 10 ug Cd/l

in the controls).

Hinesly (1974) reported cadmium contents of 40-80 ug/l in drain water from 1 m deep lysimeters receiving

50-100 tons of sludge solids per ha. The controls contained less than 10 ug Cd/l. The measurements were repeated 13 months later but did not show any significant changes.

Folsom, et al. (1976) determined profiles of water extractable and hot 8 N HNO3 extractractable cadmium beneath a landfill, receiving industrial and municipal solid waste from 1947-1960... The groundwater sampled at 20 m depth contained about 50 ug/l of cadmium compared to 20 ug/l in control wells.

Heitfeld & Schottler (1973) referred to a two year investigation of groundwater quality around 10 landfills in Aachen (BRD, Germany). They stated that in particular, cadmium was found in elevated concentrations, but unfortunately no quantitative information was presented (Christensen, 1980:10-11,13-14).

At this point it is appropriate to note that cadmium is found in the following manufactured wastes because, “many metals, especially Cd, Cu, Pb, Sn and Zn, **are dispersed into the environment in leachates from landfills, which pollute soils and groundwaters… the greatest cause for concern is currently considered to be Cd**” (Alloway & Ayers 1993:149) (emphasis mine):

Sewage sludge

Batteries

Pigments and paints

Polymer stabilizers

Printing and graphics (Alloway & Ayers 1993:147,149)

And, the following waste categories (just a selection from many), including some strangely non-specific ones, have been disposed of at the Castlereagh Waste Depot between 30 March

1990 and 27 April 95 (see **Appendix**

6):

Liquid/Sludge/Drummed/Packaged: Animal Effluent/Residues

Liquid/Sludge/Drummed/Packaged: Bacterial Sludge (Septic) Special Waste – Animal

Liquid/Sludge/Drummed/Packaged: Aq. Based Paints, Resins, Dyes, Adhesives

Sludge/Packaged: Solidified/Polymerised Wastes **Packaged: Cadmium &**

Compounds *Sludge/Drummed/Packaged: Contaminated Soil*

Sludge/Drummed/Packaged: Encapsulated Wastes Sludge/Drummed/Packaged:

Chemically Fixed Wastes

Special Waste – Contaminated Soil (Waste Service NSW 1996:Appendix II)

(emphasis mine)

Lead. The 6.0 ppm Pb in soils C and F are not unusual because Thornton (1991:64-66) has reported lead contamination in terms of inhalation (air) and ingestion (diet [through foliar deposition of airborne lead ontolettuce, cabbage, kale and spinach grown in home gardens] and dust). The Sydney Basin is well-known for carrying vast amounts of air pollution from industrial and vehicular emissions area (Hyde, Malfroy and Watt, 1982), so airborne lead is available to this property. What Soil C offers is minimal opportunity to retain Pb, as it is open ground and unvegetated. Little is retained and most would be washed away. Soil F, having the same level, is shielded by trees. Also, the resident grass (which appears to be succulent introduced species) offers a small overall surface area to facilitate retention of Pb. In stark contrast is Soil A. It offers a very large surface area through the considerable amounts of grass present. Between these extremes is Soil B wherein a notable ground cover of very small leaved grasses, weeds and scrubby plants offers a good surface area for Pb retention.

Another variable to consider here is soil depth in relation to Pb concentration. Soil A was surface soil. Therefore, the high surface area of the grasses has apparently combined with our

superficial sample to produce the high reading of 13.5 ppm. The 11 ppm in the undisturbed bush soil sample B can be attributed to accumulation. From Soil C to soil F, however, we have

the variable of sample depth, but with the *same* concentration of 6 ppm Pb in each. This might be explained through sub-surface accumulation in F (which *might* register as higher concentrations in the surface soil -- its a shame we didn't sample this), and surface *remnant* in C -- that which remains after the combined effects of horse movements, wind and rain impact, and sheet flow.

If the sub-surface soil in C is not too compacted from the horses, then possibly more extensive measurements might show the *same* concentrations in this soil, similar to those of sub-surface F. Also, surface concentrations in both C and F might be similar, however that would require C to not be subject to the above-mentioned impacts. The only way out of this kind of fascinating surmising is to *do all the tests*.

TOTAL ENVIRONMENT CENTRE INC. REPORT ON WOODWARD-CLYDE 1994 STAGE 2 AUDIT

This report (*Castlereagh Waste Disposal Depot – A Report on Community Concerns and Adequacy of Government Investigations* [1996]) is notably a refutation of the basic assumptions made in the audit. In particular, Dr Fred Bell ("a specialist in predictive mathematical modelling of complex environmental processes" *Total Environment Centre Inc. 1996:7+) noted that:

… the Woodward-Clyde treatment of water and contaminant movements exemplifies the modelling and predictions referred to in (c) *'the errors and uncertainties in such modelling are often overlooked or obscured in the mathematical details, and false impressions of reliability and confidence are therefore often conveyed in the model predictions'+. He considers this work… is based on unsatisfactory information and at least 26 implicit assumptions.

… all the assumptions are regarded as sources of uncertainty, many are questionable and several are shown to be significantly in error… Therefore, it follows that most of the conclusions from the modelling have doubtful credibility (Total Environment Centre

Inc. 1996:7).

Where the Woodward-Clyde report admitted that fluid "can move from the disposal cells into the groundwater below the Depot within a few years, explaining the observed contamination in some bores" (Total Environment Centre Inc. 1996:7), the Centre's report agreed, excepting it added the suggestion and qualification that fluid would require less than a few years to reach groundwater (Total Environment Centre Inc. 1996:8).

Where the Woodward-Clyde report stated that "contaminated groundwater is not likely to migrate more than 150m beyond the area of disposal within 100 years, and the concentration of contaminants at the migration front would be less than 1% of the original concentrations at disposal" (Total Environment Centre Inc. 1996:8), the Centre's report sharply disagreed. Simply put, the Centre said this conclusion was wrong (Total Environment Centre Inc. 1996:8). See **Appendix 10** ***A. Transcript of Field Trip and Interview with Mr Alan Jones, Supervisor of the Castlereagh*** Depot, ***B. Photos of Castlereagh Depot*** and **Appendix 11** ***Performance Rating Scale***.

POTENTIAL IMPACTS OF TIP CLOSURE ON ENVIRONMENT

The Tuesday, April 25 1995 Penrith Press announced the forthcoming, but unspecified closure of the waste dump:

A TIMETABLE for closing the controversial Castlereagh tip is expected by the end of next month following the State Government's decision to shut it down "as soon as possible" (Kerr 1995:1-3).

Although tip closure (see **Appendix 12** for details on the Closure Plan) might appear to be a good idea, the problem still remains as to how to effectively dispose of the wastes which are continually being produced.

Toxic Wastes at Local Tips?

Some concern has registered in the media as to the viability of intractable wastes being distributed around local rubbish tips. It is thought that this could be a possible 'solution' to the

inevitable closure of large waste sites due to full capacity being reached. Although this seems ludicrous in that toxic materials will then be present within many population centers (thus potentially widening the problem), this *documented* situation has already occurred:

THE Environment Protection Authority (EPA) is allowing substances to be dumped in local tips which were not authorised by Penrith Council, Mayor Ross Fowler said.

Council recently took Penrith Waste Services, which runs Mulgoa tip, to court over three issues:

• That Penrith Waste had allowed an excavation on the tip to become too big;

• That they had allowed a hill at the site to become too high;

• That certain types of waste had been dumped there without council consent (Osborne 1996:19).

Waste Dump 'Remediation', Resident Compensation and Disposal Alternatives

A bold introduction to a recent Penrith Press article stated that the State Government should buy out residents affected by toxic waste from the Castlereagh tip (Osborne 1995a:25). The same article quoted Penrith Councillor and CMC member Kevin Crameri as saying that "there will still be a health risk surrounding the tip for 100 years". This shows that, in some circles within this region, the toxicity of the tip is considered to be fact.

Crameri, in the above-mentioned article, also said that "investigations need to be carried out on the site. I believe it should be carefully secured. There is also the issue of where the waste will go" (Osborne 1995a:25). Penrith Mayor Pat Sheehy noted that "a remediation program must be carried out now on the site... The groundwater on the site is definitely contaminated" (Osborne 1995a:25).

As to what can be done with the waste, this is entirely a new, albeit connected issue with its own significant problems. Should the contaminated earth and wastes be exhumed and burnt? Case in point: A Waterloo incinerator was found to be releasing ash containing "dioxin levels up to 60

times above international guidelines" (Casey, 1990). As the situation unfolded, the acting director of the SPCC stated that higher temperatures would eliminate the health risk, whereas a Sydney engineer countered that the incinerator in question "could not burn waste at a temperature high enough to eliminate dioxins" (Casey, 1990). The point here is that technology needs to be applicable, available, very efficient and affordable (at least from the government's perspective). But will digging up the Castlereagh site (or any toher site for that matter) be affordable? And, to what extent will that 'solve' any of the problems already associated with the tip?

LOCAL SOLUTIONS?

If burying waste is unreliable, then can it be burnt? Yes, but the situation is not quite that straightforward.

For example, note the following paragraph in the Daily Telegraph (now the Telegraph Mirror) of July 1990:

A Sydney waste incinerator which has been releasing excessively high levels of toxic dioxins in a residential area will continue to operate for an indefinite period.

A Waterloo incinerator, in this case, was found to be releasing ash containing "dioxin levels up to 60 times above international guidelines".

As the situation unfolded, the acting director of the SPCC stated that higher temperatures would eliminate the health risk, whereas a Sydney engineer countered that the incinerator in question "could not burn waste at a temperature high enough to eliminate dioxins" (Casey, 1990).

If the SPCC is wrong when it comes to toxic substances and incinerators, then are we assured the SPCC is right when it claims there is nothing wrong with Londonderry water?

Impacts Conclusion

There seems little doubt that the "one million tonnes of liquid waste... dumped at Castlereagh

over the past 20 years" (Kerr, 1995:3) have found their way (at least in part) into the broader terrestrial environment. There is also little doubt in my mind that direct links can be made between this waste and human and animal suffering/death. Perhaps it is not so surprising that the evidence is clear in this regard, even if government bodies and hired assessors are incapable of admitting as much while actively discriminating against landholders through a series of emasculated investigations programmed to go nowhere?

BROADER CONSIDERATIONS: FUTURES FOR AGRICULTURE AND RURAL DEVELOPMENT

The impact of this corrupt and foolhardy form of landuse appears to be massive. This report seems to actually highlight a Government (and its various bodies) contributing to rural blight and the general decline in agricultural viability in this country. It may be the sad truth that toxic chemicals, disposed of by way of a cruel partnership between an aberrant technology's intractable and dangerous wastes and a general governmental negative view of 'working class'/rural areas, are crippling the sociological, human health and general productive potential of the Londonderry region in Sydney. And since liquid wastes move slowly (but inexorably) underground, and were also continuing to be deposited at the depot while this University study was being conducted, it may be very reasonably concluded that the sustainability of the depot surrounds have and will be, for a long time into the future, at best be severely compromised. At worst, healthy agricultural productivity (and more) may be eliminated for decades to come, given the severe and protracted nature of the general poisoning indicated by residents affected. The destruction of market gardens in the Londonderry area (Kelly, 1990) and the unsaleability of this polluted land is a crippling blow to the equitable futures of these landholders. Does this type of cover-up now lead, as so often occurs, into decades of exhausting wrangling where compensation (perhaps) eventually arrives, but only through the sheer persistence of those poisoned, blighted and wronged? Does this all-too-usual process of governmental conspiracy and denial not use up lives that could have otherwise been gainfully and happily employed in

productive activity, such as the building of inheritances (including, critically importantly, epigenetic 'inheritances') for children and grandchildren?

If so, then it can be understood that the criminal treatment of people's rights destroys many kinds of resources and leads to, not only the perpetuation of destructive practices (such as the burial of chemicals), but also the loss of equity for generations to come.

Rural development requires the health and full working capacity of rural inhabitants, along with equitable conditions (climatic perturbations can be planned for, but Government conspiracy and antagonism is almost impossible to fight), to enable a sustainable input of ordering energy to benefit rural communities. However, many Londonderry residents complain of compromised health (not to mention a compromised attitude toward Government bodies) in the form of chronic bronchial, eye and skin irritations, lethargy and asthma. Further to these are the more devastating mutations amongst children and teratogenic impact on pets and farm animals.

Now, it takes no great appreciation of medicine to realise that optimism and energy cannot be sustained indefinitely in the face of epidemic human and animal health problems. Some few individuals may draw on seemingly inexhaustible reserves of patience and fortitude in order to overcome adversity, but most may be more disposed toward cutting losses and getting on with their crippled and potentially catastrophically shortened lives – elsewhere. If people leave their rural environment because it is sick and because they are sick, then that rural setting is depleted of human talent and input. It becomes a dead zone. The community will suffer.

Even those who, through sheer expression of will, remain to 'continue the fight', will not see their efforts expended for normal return because their properties and bodies cannot operate to full capacity. If watercourses are fouled and must be fenced off from stock; if reproduction results in mutations, illness, erratic behavior and deaths among humans, livestock or wildlife; if properties cannot produce saleable materials, then the land which is, ultimately, everything of importance to all, is poisoned and worthless land and good for nothing, except, maybe, a toxic

waste dump... Lives that could have produced imaginative and constructive legacies for others have instead been wasted on waste. This is the outcome of toxic, synthetic chemical production and disposal in a reckless world that does not scrutinize its inventions and motivations.

3. Performance Rating

A. WASTE BURIAL AND CHEMICAL CONFINEMENT RATING

In this section, we look at how Waste Service NSW rates in the area of contaminant containment. Are the indicators in favor of the clay cells at the dump site being successful in restricting the movement of chemical wastes off-site? First, some relevant research material. Wastes are often buried within clay cells in the ground. This is the case with the Castlereagh tip:

The primary function of a clay liner is to restrict leachate seepage from the landfill by virtue of its low hydraulic conductivity (Farquhar 1994:37).

Chemical waste should be restrained from moving through clay, however this author says that, “concern about the suitability of clay liners for municipal solid waste (MSW) landfills has increased in recent times because of certain liner failures...” (Farquhar 1994:38). Does this mean that waste, once buried, may leak? This is such an important point I will repeat a quote already stated from an earlier section:

The objective of controlling the hydraulic conductivity is clearly one of limiting advective contaminant transport (ie the movement of contaminants with moving water) through the liner. However, despite more than a decade of research and the existence of good supporting field data, it is only recently that it has been generally recognized that *there is a second contaminant transport process* which will occur even through a very low hydraulic conductivity clay liner: that process is chemical diffusion. ...diffusion may be the dominant contaminant transport mechanism in a well-constructed clay liner.

Furthermore, contaminants can escape from a waste disposal site, by diffusion through

a liner, *even if water flow in the liner is into the landfill* (Rowe,1994:219) (emphasis mine).

Rating for Waste Burial and Chemical Confinement

In consideration of the long list of negative health reactions (in animals and humans) in the site area, the admission by the EPA that groundwater under the site is contaminated, and the above evidence of liner failure, we must rate the Castlereagh dump for this category: **0/10**.

B. AUTHORITY/GOVERNMENT CONCERN RATING

Relevant authority/government concern can be summed up by these quotes:

The WMA's technical manager Ross Thomas said problems on *the Anonymous Londonderry Landholder's+ land was not the authority's responsibility (Bender 1990:3).

The Waste service has consistently denied the tip has caused any contamination to Castlereagh and Londonderry properties outside its boundaries (Kerr 1995:3).

The licence issued by the EPA to the Waste Service to operate the Castlereagh Toxic Waste Depot states that the Waste Service must comply with Section 16 of the Clean Waters Act. The Clean Waters Act states that it is an offence to pollute any water, including underground water. Tests as late as the Stage 2 Audit last year [1993] confirmed that the depot is contaminating the groundwater -- yet the EPA continues to take no action against the Waste Service for this continued non-compliance of the licence condition (RAGE 1994:4).

Rating for Authority/Government Concern

Due to the EPA's reluctance to prosecute Waste Service NSW, the consistent indications of suppressed information on chemical contamination levels, the concomitant overall disregard for residents' health and the general inability of government-hired 'experts' to relate symptoms to contaminant sources, we must rate this section as **0/10**.

4. The Wider View – Chemical 'Safety'

Worldwide

STORAGE AND SAFETY OF CHEMICALS IN SYDNEY

Risks from chemicals abound even when little is being done with them; an obvious example is the ‘neutral’ storage of often volatile and explosive substances.

A huge chemical fire at Diversey’s chemical factory at Seven Hills, caught the attention of the State Government in December, 1989 when a toxic cloud “forced the evacuation of hundreds of homes in Sydney’s west” (Totaro, 1989).

The same article said that a meeting of Cabinet Ministers was held in response to the toxic cloud to “co-ordinate Government action in the wake of the fire”. Inquiries, the release of a draft State Environmental Planning Policy on hazardous industries (providing guidelines on the siting and safety specifications of future chemical plants in NSW), and the appointment of a Westmead Hospital medical officer specifically to monitor the health issues relating to the fume cloud, were some of the initiatives proposed by the Cabinet meeting (Totaro, 1989).

Obviously, from the above, when people’s lives and health are directly and overtly placed at risk, the Government is quick to respond with some considerable noise and a flurry of literary activity, as well as, perhaps, stiffer penalties and more intense requlations imposed on those who are deemed to be the culprits.

And there is need for this type of symptomatic reaction for, as the article shows all too clearly, Sydney has many chemical storage sites located throughout its urban sprawl. And this is the case with most large cities which have not been planned effectively.

In order to highlight this mish-mash of residential and industrial areas, note that the following PCB stores are situated in Villawood and Botany; chemical stores are found in Chester Hill, Dee Why, Balmain, South Granville, Botany, Rhodes, Homebush, St. Marys, Wetherill Park, Parramatta, Kurnell and Minto; fuel stores are sited in Botany, Ermington, Clyde, Auburn, Mascot, Penrith and Katoomba; LPG stores are found in Botany, Mortlake, Kurnell and

Blacktown; and agricultural chemical sites are situated in Seven Hills, Pendle Hill, Kurnell, Tempe and St. Peters (Totaro, 1989).

Many of these areas have medium to heavy population densities, and many storage sites have been implicated in the past in regard to, especially, fires and their associated explosions and gas clouds. These incredibly visible events get a great deal of press and at least some form of reaction from the Government.

WORLDWIDE TREND OF CHEMICAL IMPACTS

In most cases, it is not the storage or burial of chemicals that is the greatest threat to agriculture and, indeed, all development (although some very notable spillages and burials have occurred and wreaked monumental destruction within local and expanded areas). It is the use and application of chemicals that succeeds all other chemical translations in potential for damage. In this regard, I want to examine chemicals from a particular perspective.

In this age, chemicals have been brought into existence which have never, in all history, existed. This is due to very ‘advanced’ (or insanely ignorant) modern technologies. These compounds are not compatible with the structure and functioning of this world ecosystem, or the 'metabolism' of this particular orb, if you like. In thus viewing the earth’s environment in much the same manner as one would view the human body (which takes all its sustenance from the earth), it can be understood that many, if not most, of these artificial compounds are, by their very nature, exceedingly injurious to all biomass and the substrate upon which earth’s biomass and all life depends. These chemicals accumulate in the earth’s ‘tissues’, react to form, often, new and unknown compounds ("metabolites"), and lead to a distortion of geological composition/function and groundwater characteristics. The surface environment around the Sydney Castlereagh Waste Management Centre (see other articles) is a perfect example of these aberrant processes in action.

In polypharmacy, whereby multiple drugs are administered (by a doctor’s prescription, or

through personal selection) to an individual, no-one is able to predict the outcome of the numerous chemical combinations and reactions that occur within the tissues and organs. The only solid outcome that is now known is that ‘modern’ diseases are appearing and spreading at a frightening rate, including immune deficiencies of many varieties. These modern plagues, which include multiple allergies, are now directly linked to well-established environmental toxins produced by our great benefactor: technology.

Now we see the natural world limping and retreating before the onslaught of artificial chemicals. Man, whether he is a city-dweller or a rural inhabitant, is literally ‘swimming’ in a sea of toxic compounds. They assail him in the meats, fruits and vegetables he consumes, in the air he breathes and within his own home. Here, pesticide residue gases rise up from the concrete slab (as occurred in my own New South Wales Department of Housing unit after two pesticide treatments were forced upon me). Toxic outgassing from synthetic building materials and interior adornments add to the ‘gas chamber’ effect. Cleaning agents outgas and cling to the skin and enter the lungs, and detergents pass from clothing through to the bloodstream. All these products that man has desired have come about through forms of poisonous technology which we have worshipped as suposed benefits arising from the god of economic growth. This growth god does not consider the compatibility of its lethal products with the foundation of all life, all biomass.

So, the status quo we witness today – that is, all ‘economic growth’ – is based on, inescapably it seems, the chemically and profit-driven obsessions of modern industry. The vastness of the problems we now face arising out of this obsession can only be appreciated when we realize that very little of what we now have and use could exist without synthetic chemicals. We are largely ignorant of older, more self-sufficient lifestyles compatible with untouched nature, and utterly dependent upon an artificial world of our own misguided creation. We have become ourselves, and we have made this green earth, drug-addicted. But this is not entirely a modern problem, as

research shows that man has carried this proclivity to pollute the environment with him, down through the ages.

Historical Toxicity

This problem is now known to have extended back at least as far as the military and economically-driven

'Renaissance' of Roman and Greek times when smelters marked "the oldest large-scale hemispheric pollution [around 2,500 to 1,700 years ago] ever reported, long before the onset of the Industrial Revolution" (Hong, et al. 1994:1841).

It continued with the ancient practices of alchemy in the Middle Ages, when kings and emperors were often sent mad by concoctions of eternal life dreamed up by their sorcerers. These elixirs sometimes contained mercury.

Today, we put mercury in amalgam fillings, and strangely,

relieved individuals tell of the reversal of 'modern disease' symptoms once these fillings are removed.

Global and Political Toxicity

Toxic chemicals are used worldwide and are proscribed by none that have real power. Within this conundrum offering no tangible solution, we find that we cannot retreat 'back to nature' where real and truly sustainable progress would be more dynamically afforded (although in limited projects some good results appear as an oasis amid desert sands) because, overall, we have neither the will, sufficient knowledge, nor the power.

The transnationals who control governments and exploit the vast riches of the Third World (with total disregard for indigenous inhabitants) will not allow a wholesale translation and permutation sideways, away from their industry-based world and into a simpler and more independent and unilateral relationship with this earth. This is because industry, orthodox medicine, civil government and orthodox religion generate, collectively, a complex cultism of

elitism, and with this delusion of grandeur a persecuting attitude toward non-conformists or, the 'heretics' who strive to invent self-heal, believe and live apart from the inquisitorial ideologies set in dogmatic and politically-correct, ever-expanding legislation and religious doctrine.

We have created a pervasive, insidious and addictive monster that will not permit a broad resurgence backwards into truly sweeping reform. We share our homes and communities, our businesses and our farms, our waterways and oceans with thousands upon thousands of chemicals. What do we do with these substances when we're finished with them? What do they do to us when our backs are turned, when we work, play and sleep? The answer is to be generally found, not in the wind, but in our livers and in cancer wards where obedient patients allow physicians to experiment with yet more drugs.

Global toxicity *is* political toxicity, because industry manipulates government. Therefore, there is little room to fight and, considering the overwhelming weight of technological tradition arrayed against reformers, there are few chances available where global improvements can be gleaned.

In order to begin to live without chemicals, one must know one's 'enemy'. And, look what we are all up against.

The Pesticide Dilemma

Pesticides and drugs kill pests and 'bugs', but they also kill the predators of pests and enlist the development of resistance in succeeding generations of insects, weeds and pathogens. So, we inevitably arrive at stronger and more resilient pests and stronger and more toxic chemicals to control these 'super-bugs'. And humans, animals and the environment are all poisoned in the process. Now, is this maniacal slide into a stampeding toxic oblivion worth the pain of chemically induced disease, mutated livestock and sterile market gardens and orchards?

There are now some 35,000 different commercial products to control insects, weeds, fungi, and other destroyers. The federal government has the responsibility of permitting on the market only those whose benefits outweigh their risks. Scientists often debate

among themselves the efficacy and reliability of the tests used in making that determination (Grosvenor, 1980).

The above quote refers to the US, and that in 1980. How many more chemical products must be available now, worldwide?

The ‘tests’, as mentioned in the above quote, are unreliable for three reasons:

1. The tests are all too often biased in their application (much weight of influence from manufacturing giants is applied to the largely political process of getting chemicals passed);
2. The tests test highly toxic compounds, most of which are toxic to humans and animals alike regardless of whether the chemicals are passed or not, and regardless of the specifications and precautions allotted to them. This is especially so because chronic toxicities and multiple and compounded chemical interactions are largely disregarded and undiscoverable.
3. The tests cannot keep up with the sheer volume of new chemical compounds introduced to the market.

Basically, we are looking at a no-win situation. Maximum residue levels, poison schedules, and pesticide registration and regulations in reality mean very little, despite all the technical hype surrounding the manufacture and certification of chemical compounds. These substances will generate indiscriminate poisoning, however they are used.

A farm worker, interviewed by National Geographic, said: “Imagine how strong the sprays were: I mixed them in new plastic buckets that began disintegrating in three days” (Boraiko, 1980:144-183). The same article had 2 frightening warnings against the use of pesticides:

According to Dr Frank H. Duffy of the Harvard Medical School, exposure to even tiny quantities of certain insect killers similar to those found in the home can alter brain activity for more than a year, and cause irritability, insomnia, loss of libido, and reduced powers of recall and concentration.

But synthetic pesticides soon showed a darker side. As early as 1946, DDT no longer

killed all houseflies. Red spider mites became destructive apple pests as unselective pesticides decimated predatory mites that once held them in check. Some insecticides, slow to degrade, accumulated to lethal levels in the food chain, killing fish and birds. Ominously they began concentrating in human fat and mother's milk (Boraiko, 1980:144-183).

These are the characteristics already noted in past years in the Londonderry area of Sydney: unexplained sickness, debility and deaths among the residents surrounding the Depot, and freshwater fauna and birds dying.

And, further to the above:

The pesticide planes keep coming and the cemetery keeps growing, but who will listen? (Reed, no date:30-32).

So goes the opening paragraph of the article: 'The Town Where Death Stalks Children', by Christopher Reed. Reed is describing the town of McFarland in Kern County, in California's San Joaquin Valley, one of the richest agricultural areas of the world, yet savagely blighted by chemical pollution. Reed says this pollution is considered by many environmentalists and agronomists to be one of the worst cases in the world. The author also notes that this community is the victim "of an extraordinary occurrence of cancer that still remains officially unexplained..." More recently, the carcinogen DBCP (dibromochloropropane) has been found in well water in McFarland. DBCP was comprehensively banned around 1978 because of its lethal potency (Los Angeles Times 1988). Considering the current performance of authorities as noted in this document, 'officialdom' is obviously seldom in the habit of seeing disasters like this as actually having a cause. Inconvenience.

A Monumental Health and Scientific Dilemma

Worldwide, highly toxic levels of wastes have been established in many areas and are now, as very adequately shown by growing incidents of illness, mutation and death, going on to who

knows what further destruction, especially in terms of reproductive effects. These chemicals are so completely alien to the environment, it is impossible to predict the outcome of their concentration within the food chain. Accumulated knowledge of natural systems is inadequate to account for the innumerable toxic combinations possible within the web of life, and the utter stupidity of introducing vast numbers of chemicals to the world is always countered by industrially financed advertisements of enhanced 'benefits'.

Requiem

What of the many species of plant and animal which are unknown? And what of geologic and other processes that are only partly known or yet to be discovered? In what altered state will they be in if and when their existence becomes documented? We may, in fact, never be able to fully appreciate some lifeforms and natural processes because they will have been extinguished or irreparably changed by our activities on and below the earth’s surface. This is a monumental tragedy for research. Many of our scientific endeavors in the future will necessarily involve a progressive adding to a ‘Book of the Dead’, a morbid listing of our biological resources and earthly companions obliterated by the onslaught of invasive, chemically-based technologies.

5. Conclusion

PRELIMINARY NOTE

First and foremost, before addressing any specifics in this conclusion, this author must state that

he unequivocally believes, after much research, that the **Castlereagh Waste Management Centre** is the cause of a significant proportion of the human, plant and animal diseases, disease-related deaths, teratogenic and even mutagenic responses experienced on properties surrounding the waste depot. More particularly, this statement relates to the rates or incidences of these diseases and deaths above what is generally determined to be normal, given *reliable and unbiased epidemiological research*.

DISCUSSION

Human Trauma, Politics, Media and Community Empowerment

During my Degree study of this issue, the most notable signature of the waste dump operation was unquestionably the health impacts arising from this singularly distasteful mode of landuse. The degrees and longevity of trauma imposed on Londonderry (Sydney) residents cannot be quantified because stresses imposed by the depot leakage of toxic substances have blasted and feathered out into numerous overtly and covertly, as is usually the case with largely invisible chemical poisoning incidents. Lives and livelihoods, human potential, health and psychiatric states have been skewed and destroyed, and marriages placed in jeopardy. The negative consequences experienced by the participants of this massive chemical ‘experiment’ are too far-reaching to imagine, involving not just the destruction of environmental health via xenobiotic poisoning, but also the destruction of faith in government. Here we witness landholders who have been pressured to doubt their observations and very sanity. Here we see self-perpetuating corruption and conspiracies that shunt truth aside entirely (especially where a researcher has been warned away from conducting tests on the Londonderry environment on pain of a family ‘accident’), and where welfare and justice for the ordinary people are placed firmly out of reach. As such, this ‘bowl of spiders’ had evolved into a conundrum enmeshed in a web of political denial, contradiction, intrigue and suspiciously handicapped health studies.

Somewhat more visible to the wider audience was, of course, the extremely high level of media

attention previously given to these events and the dynamic public concern that flowed from this. This concern resulted in community empowerment through the formation of environmental groups. These hardy groups and members stepped into the political arena to do battle over this immense terrestrial environment contamination issue.

Authorities' Claims Refuted by Student Determinations

The various authorities involved, most notably Waste Service NSW, the EPA, Department of Agriculture, State Government (Environment) and "the internationally recognised environmental consultant, AGC Woodward Clyde" (Hartcher 1994) had consistently promoted the perception that chemical burial at the Castlereagh waste depot was professionally executed, and that the public were therefore not in any danger from exposure from these buried chemicals. The dangerous substances were said to be safely tucked away under the ground where they could not hurt because they would, forever and a day, remain isolated and essentially static. In sharp contradiction to this incredibly near-perfect theoretical image of amazing grace was the patently obvious fact that the Castlereagh dump was not containing its buried secrets and was leaching toxic materials onto local properties. Bore analyses proved this point unequivocally.

From three student studies of the issue in the 1990's, and our determinations of unusual levels of sodium chloride, the toxic heavy metal cadmium and phosphorus in soils, surface waters and borewater on a property near the waste dump, we concluded that these findings merely indicated the tip of the toxic iceberg. Our study of residents' complaints also substantiated this thought. As well, we noted that sufficient admissions had been made by the EPA and auditor borewater test results to provide conclusive evidence that the Castlereagh Waste Management Centre was leaking harmful chemical wastes offsite. Further to this, the leakage was extensive, invasive, extremely toxic, and could jeopardize the health of the surrounding communities for decades to come.

We understood full well that much information had been secretively withheld from public

scrutiny in order to avoid embarrassment, prosecution and potential compensation claims from affected landholders near the waste site. Along with this insidious situation, it had become patently obvious that epidemiological and agricultural research had not only failed to generate professionalism in the methods applied, but had been purposely and consciously weighted in favor of diffuse and inconclusive outcomes.

The Final Word

In this study we examined local and overseas examples of chemical poisoning, and noted similarities that are certainly more than simple coincidence. The cases examined clearly synchronize as per a common chemical waste denominator, one active and menacing in its deadly embrace of people's lives.

The symptoms of modern diseases, unexplained animal behavior, deformities and deaths, wildlife deaths, and the killing off of trees, pastures and crops, clearly described the escape of xenobiotics from their tombs and their consequent movement into human populations within their toxic reach. The symptoms also strangely pictured an ignorant and foolish dependence upon synthetics within the distorted framework of an all-embracing trust in modern technology. These horrors are so unsolvable and unpalatable for the many authorities that oversee these processes-turned-disasters, that the perpetuation of lies and coverups becomes an essential imperative to the survival of blind community trust. Within this regime of indoctrination and subterfuge, political damage control is elicited within the sequence of inflamed events to maintain the typically bureaucratic notion of 'order', so that suspicion and dissent is kept to a minimum. But this general political/industrial/medical cultism and hypocrisy that defrauds communities of their rightful access to unbiased investigations, information and compensation, leads ultimately to intense distrust and 'disorder' (or dissent, or protests/campaigns/revolution). For what government through history has ever maintained a permanent totalitarian reign over a populace which it defrauds and scourges?

All these issues are tied together and present as an immense challenge to the collective mind of humanity, especially when that collective mind begins to more seriously appreciate the environmental and human health imperatives painfully reaching forward into our rapidly deteriorating and diminishing futures. We must understand that the quality of those futures is now dynamically compromised through the insidious impact of chemical waste. Not only this, but also the wasting of resources in the perennial fight against abusive bureaucracies drains away the ability of all people to contribute energetically toward positive and enlightened repair, recovery and advancement.

Here in Australia and elsewhere, the 'legacy' of chemical creation, storage, burial and leakage reaches back into history and asserts its dominance ahead of our children's children as a burgeoning human health pandemic threatening to break the viability of the human race.

If we are rendered sick, deformed or dead before our time, then our personal situations and the potential of those with whom we share close bonds are and have become sadly diminished.

Long-term environmental toxicity cuts back productivity and taints what little of value remains. Returns shrink as diseases multiply. The poor cannot invest and cannot pay interest. Equity is emasculated or lost altogether. A damaged and pathologically poisoned landscape cannot sustain normal life. Toxic chemicals hold all life-forms to ransom.

If technologically generated poisons bring the earth's 'metabolic pathways' to their knees and thereby severely impair bio-viability and bio-diversity, then there will be no productive, sustainable and equitable futures for, ultimately, any individual on this planet.

We continue to imagine that the technology of alien compounds is an expression of intelligence and ‘progress’. Perhaps, just perhaps, our definitions of human curiosity, invention and advancement are fatally flawed.

The threat to life is unimaginable. The consequences of present habits are too horrible to allow our lifestyles to remain unaffected and unaltered, swimming, as always, in a lethargic sea of

apathy and ignorance. We are a world population addicted; a teeming mass of chemical-dependents swarming from pole to pole and blundering, lemming-like, toward an unknown oblivion, UNLESS we pull back from this lunatic madness and permanently discharge the economics and politics that bind us to anti-environmental greed and dispassionate technologies fighting for world dominance.

These are the days, not for pharmaceutical transnationals with pathological visions of profit and world order, not for the relentlessly tiresome patronage of obsessive technologies; no, these are the days for bright and simple ideas, old ideas that can remarkably sweep aside dead-end inevitabilities and focus on holistic, sustainable and equitable attitudes, as well as knowledgeable pathways to natural and non-invasive uses of world resources.

These are the days for PROFOUND CHANGE.

6. Recommendations

In view of the enormity of this local issue, the pain and suffering expressed by those affected, and the seeming intractability of this waste disposal problem, we feel we need to make the following significant recommendations:

• That the waste site be closed and remediated to the fullest extent possible, regardless of the cost. Before full closure and remediation are due to be implemented, any waste cells forthcoming should be lined with materials impervious to chemical degradation and diffusion (eg Teflon linings).

• That waste and water be pumped (and scoured) out in order to lower the watertable under the waste site and thereby minimize the spread of contaminants (the depot is on high ground). In other words, pumping should be generated on a level which would create a *mechanical* gradient back *into* the waste site (because of chemical diffusion, this would not be entirely satisfactory, however). The wastes thus gathered should be thoroughly destroyed by high temperature incineration (again, cost should not be a limiting factor here). Incineration facilities to deal with

the end-problem of the depot waste should therefore be given the highest priority at this point in time (as well as other technologies to *limit* production of the wastes in the first instance).

• That strict monitoring of all watercourses around the waste site (eg South and Rickabys Creeks, and the

Hawkesbury River) be conducted, and all results made available to the public.

• That Government and associated departments be made entirely accountable for past and ongoing contamination of the Londonderry area around the waste site, and that full disclosure of *all* test results (past, present and future) be made available to the public.

• That the above also include the exhaustive disclosure of *all* contaminants deposited at Castlereagh, both officially and unofficially.

• That government agencies and individuals found to be involved in coverups in regard to this issue be prosecuted to the fullest extent of the law. All records relating to the depot and intersecting studies should consequently be made available to the public.

• That the culture of self-justification, denial and damage control inherent in political activities be fully addressed through an extensive Inquiry.

• That further independent human, animal and plant health studies be incorporated into an overall epidemiological strategy involving wider terms of reference than previously flawed studies. This strategy would intensively examine all sources of contamination and exposure pathways honestly and vigorously identified, and determine the causes of the elevated disease incidence in the Londonderry area. Toxicological studies would also be incorporated.

• That landholders affected should receive singularly generous compensation for pain, suffering, loss of income/productivity, disease and death contributed to by toxic leachates and outgassing originating from the disposal of wastes at the Castlereagh site.

• International forums should be generated in order to focus on economic theory, technology, resource use, trade and how these relate to unsustainable patterns of behavior, activity and

outcomes.

7. Reflection on Study

EXPECTED OUTCOMES FOR ISSUE

1. That contamination episodes will continue to occur on the properties surrounding the depot.

2. That disease incidence in stock, wildlife, flora and humans will continue to manifest in above-average levels in these areas.

3. That government bodies will continue to deny any responsibility in depot leakage and consequent pollution.

4. That these same bodies will likely sponsor more epidemiological, geological, agricultural and environmental studies that will likewise be emasculated via limited terms of reference, and purposely biased and flawed methodologies.

5. That no *real* compensation for affected landholders and *children* (this is a very long-term view) will be forthcoming until/unless solid evidence is produced of corruption and collusion in 'high places' in regard to this issue. Some *limited* compensation might be made available if sufficient injury and suffering can be made known, however this would never be based upon any official statement admitting to depot leakage and government liability. Expect, also, that the limited compensation would be offered together with pronouncements noting nothing in particular and allied with synthetic, abstract and cold statements of empty sympathy.

CONCLUSIONS REACHED

This issue has left me with an absolute disgust for authority in regard to this issue in particular, and 'government' in general. I never cease to be amazed at how 'human nature' can be so antagonistic and uncaring toward human flesh and dignity in order to maintain an appearance of propriety.

I can see clearly, as a result of being immersed in this issue, that 'equity for all' is something of a desperate dream, forever being nullified and obliterated through the formidable powers of

vested interests. It may not be too unrealistic to state that life is a battle for many, a calamity for some, and a heartbreaking misery ending in mutations, disease, death and absolute neglect for the rest. Certainly all four conditions of being have visited far too many of the residents around the Castlereagh Waste Depot.

POSSIBLE IMPROVEMENTS

These observations relate moreso to my technical and methodological approach in embracing this issue.

1. Interview more individuals across-the-board in relation to this issue.

2. Visit more sites and conduct more extensive testing.

3. Extend epidemiological and toxicological studies begun at my University and conduct a detailed health survey of the residents around the waste depot.

REVIEW ARRANGEMENTS

My review arrangements are set out as follows. These necessarily involve a very longterm focus on this extremely interesting and distressing issue.

1. Examine data gathered (eg chemical types, intrusion/diffusion/contamination potential, teratogenic and toxicological effects related to levels of exposure) on a periodic basis in relation to future or extended studies and findings. These would include further private, student and other depot-related studies (eg EPA, Woodward-Clyde, etc), scientific journal articles on toxicological and epidemiological studies, and WHO and other authoritative bodies' revisions and/or additions to presently stated information. Also, for the sake of balance and even, possibly, *truth*, study **alternative** information available on toxicology, disease production and control, etc (eg information generated by naturopaths, Traditional Chinese Medicine [TCM] and the like).

2. Continue to monitor manifestations of pollution and past analyses of same.

3. A consistent media watch, together with interviews with landholders and government

bodies where

possible. The *nature* and *orientation* of these individuals' and organizations' reactions are a pertinent study in themselves in regard to human psychology.

4. In this regard, then, meta-studies might be in order.

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