

South African Water and Mining Policy: A Study of Strategies for Transition Management

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1. Introduction

South Africa is both famous and notorious for many aspects, including the dismal history of Apartheid, which saw institutionalized human rights abuses. The less known aspect is related to water quality and human health, specifically as it pertains to a water-constrained country with a mining-based economy. This chapter presents five policy paradigms as they pertain to the evolution of water policy in the South African mining sector, each of which emerged as a result of a specific shock event. The evolutionary process is about three distinct policy monopolies and the orbit of policy brokers, policy entrepreneurs and policy opponents, like electrons around a nucleus of an atom, connected yet separate. Of necessity this chapter will focus on the Fifth Policy Paradigm, giving only a brief overview of the earlier phases of policy evolution to help contextualize the analysis. The Fifth Policy Paradigm yields the type of data we are interested in within the context of this book – the role of individuals and strategy in transition management. The Third Policy Monopoly currently in existence has created policy tension, which is unresolved at the time of writing. This yields interesting data about strategies of transition management, their limitations and their potential for success, in a high stakes game revolving around naked human greed and the pursuit of profits, versus an emerging human rights culture.

2. The Relevance of Water Policy in South Africa

South Africa is a water-constrained country (Conley, 1996; Basson et al., 1997). The earliest writers on the subject described the aridity of the country, which has always been one of the key limitations of economic growth and development, and hence political stability (Turton, 2007). The National Water Resource Strategy, the official government blueprint on water resource availability, indicated that in 2004, around 98% of the total national water resource had been allocated at a high assurance of supply level (NWRS, 2004), with many water management areas being over-allocated and thus 'closed' (Turton and Ashton, 2008). South Africa has thus reached the hydrological limit of economic development using current technologies, which was predicted during the Commission of Enquiry into Water Matters in 1966 (RSA, 1970; Turton et al., 2004). Future economic growth will be determined by how water policy is changed, and how technical capacity is built during the current transition, to reflect this reality.

South Africa has a mining-based economy. Given the geology of the country, gold deposits are often associated with other heavy metals including uranium (Werdmüller, 1986). To date there are 8000 derelict and ownerless mines on record, all of which are unrehabilitated and are costing the tax payer ZAR 100 billion (1 Euro = 10 ZAR) (Brown, 2007). There is no clear policy on mine closure in South Africa that meets both the human rights standards set in the Bill of Rights of the National Constitution (1996) and the Polluter Pays Principle enshrined in the National Water Act (1998). There is an unresolved question as to whether mine closure is about mining, water resource management, human health, economic development, legal liability or simply ecological rehabilitation.

South Africa has a history of human rights abuse, of which there have been a number of specific phases. This includes the Great Cattle Killing of 1856-1857 (Meer, 1900; Welsh, 2000; Peires, 2003); the ethnic cleansing of the *Mfecane* from 1816 to 1828 (Van Jaarsveld, 1975; Thompson and Lamar, 1981; Edgecombe, 1986; Welsh, 2000; Turton et al., 2004); the Second Anglo-Boer War from 1898 to 1902 that saw the first use of concentration camps (Fawcett, 1901; Hobhouse, 1901; Krebs, 1992; Pakenham, 1992; Farwell, 1999; Hasian, 2003; Mills and Williams, 2006; Turton et al., 2006); and the dismal policy of Apartheid (Meer, 1990; Du Toit, 1994; Lodge, 1994; Odendaal, 1994; Ross, 1999). This has left a legacy of winners and losers, which is highly relevant to any contemporary policy debate, as the Policy Paradigm of Redistribution takes root. The recent xenophobic violence is simply a new manifestation of this unresolved policy debate (Johnston and Bernstein, 2007; Dixon, 2008; Sibanda, 2008; Walker, 2008).

[Insert Figure 1 here]

3. Five Phases of the Policy Paradigm of Extraction

The essential problem is that the existing mining policy reflects a historic legacy in which powerful financial interests coincided with the interests of a racially-defined political elite, which saw government becoming a collaborator rather than a regulator of the mining industry. This manifests as the Policy Paradigm of Extraction with five distinct phases to it (named for analytical purposes as Policy Paradigm's I – V). The relevance of this becomes apparent when one notes that water policy *per se* has been highly responsive to changing political demands, embracing human rights concepts that

are considered to be progressive (De Coning and Sherwill, 2004). This is totally at odds with the mining policy, which still reflects the historic power structures that underpinned it for so long, currently manifesting as a poorly-defined hybrid of the former Policy Paradigm of Extraction. This needs to be understood in the context of growing disillusionment at the way that some political elites have allowed their gate-keeping positions to delegitimize the democratic political process by introducing corruption to the highest echelons of government (Feinstein, 2007; Johnston and Bernstein, 2007; Muller, 2007), underscored by a growing public awareness of future ecological disasters (Eybers, 2007; Avni, 2007a; 2007b; 2007c; Gosling, 2007; Groenewald, 2007; NNR, 2007; Secretary to Parliament, 2007; Tempelhoff, 2007b; 2007c) and human health problems (CSIR, 2008; Turton, 2008).

In order to analyze these complexities in a systematic way, we need to understand the process by which the five phases of the Policy Paradigm of Extraction evolved.

3.1 Policy Paradigm I: British Hegemony and Gold (1910 – 1948)

South Africa was born as a country out of the ashes of the Second Anglo-Boer War fought over gold (Turton et al., 2006). Water policy at this time was driven by the need to establish a high assurance of supply for the mines, and therefore initially saw the British military engineers performing the task until the Rand Water Board (RWB) was established in 1903 (Tempelhoff, 2003). The Act of Union in 1910 established a self-governing British colony composed of four smaller units, two of which were former British colonies (Cape and Natal) and two of which were vanquished Boer republics (Transvaal and Orange Free State) in which gold was found (Geldenhuys, 1984). The

rationale for the Union was resource capture, which thus became a driver in the Policy Paradigm of Extraction still relevant today. A key element of this phase was a period known as the 'Midas Touch' or 'Long Economic Boom' lasting from 1934 to the mid 1970's (Geldenhuys, 1990; Ross, 1999) (see Figure 2). Policy Paradigm I was driven by the British with the sole objective of extracting mineral wealth from South Africa, giving rise to the Policy Paradigm of Extraction, which took place in the total absence of any human rights culture.

3.2 Policy Paradigm II: Rise of Afrikaner Hegemony (1948 – 1961)

Transition to this phase occurred when a group of Boer elites, many of whom had been interned during the Second World War for their pro-Nazi sentiments, seized the moment and won the 1948 general election (Liebenberg, 1987; Turton et al., 2004; Mills and Williams, 2006; Turton, 2006) ('A' in Figure 2). A characteristic of Policy Paradigm II was a split between economic power (in British hands) and political power (in Afrikaner hands), but with an invisible undercurrent of growing Black resistance (Liebenberg, 1994). The end of this phase occurred during a period of policy instability, started by a speech made by Harold Macmillan, the former British Prime Minister, in February 1960, in which he referred to the 'Winds of Change' that would sweep across Africa (Turton et al., 2004; Turton, 2006). A series of protest marches took place and one became a major crisis known as the Sharpeville Massacre (Spitz and Chaskalson, 2000) triggering a loss in investor confidence ('B' in Figure 2). Government response to this was brutal, giving rise to the Armed Struggle as passive resistance to Apartheid gave way to a new armed militancy, driven by the founding of the Pan Africanist Congress (PAC) in 1959 (Liebenberg, 1994; Lodge, 1994) and the formation of Mkonto we Sizwe

(Spear of the Nation) (MK), the armed wing of the African National Congress (ANC) a short while later (Williams, 1994). South Africa started to become a pariah state as a result of these events, making state survival a significant driver of policy.

3.3 Policy Paradigm III: Collaboration of State and Industry (1961 – 1976)

The policy instability that gave rise to this transition resulted in the banning of the various liberation movements, which went into exile. On the economic side, the policy was one of rapid growth, driven by gold, but also aimed at diversifying the economy and restoring investor confidence. The Jordaan Commission of Enquiry (Jordaan et al., 1960) recognized that the only way to mine the deep ore bodies of the Far West Rand was to dewater the dolomites above the reef. A Commission of Enquiry into Water Matters was launched in 1966, during a period coinciding with the end of the era of the ‘Midas Touch’ or ‘Long Economic Boom’ (Geldenhuys, 1990; Ross, 1999) (see Figure 2), with the objective of doing a strategic-level study into the national water need for rapid economic development (Turton et al., 2004).

[Insert Figure 2 Here]

In 1963 agreement was reached between the Government and the Chamber of Mines on dewatering of the dolomites of the Far West Rand (van Eeden, 2007). Two institutions were formed to deal with issues pertinent to this dewatering. The first was the State Co-ordinating Technical Committee on Sinkholes and Subsidence (SCTC), tasked to deal with the loss of life and property from sinkhole formation and land instability arising from the dewatering process (Kleyweght and Pike, 1982; Adler et al., 2007b). The

second was the Far West Rand Dolomitic Water Association (FWRDWA), tasked to deal with compensation matters arising from dewatering (van Eeden, 1992; Adler et al., 2007a), consistent with some of the recommendations of the Jordaan Commission.

During the early portion of Policy Paradigm III, the Armed Struggle was starting to take effect, with attacks by the African Resistance Movement (ARM) (Du Toit, 1994), by MK using explosives set at key points (Williams, 1994) and by the *Pogo* wing of the PAC using machetes and axes to kill and maim White people who had been labeled 'settlers' (Lodge, 1994) similar to the Mau-Mau uprising in Kenya. Despite these sporadic attacks, the relative political stability arising from state repression, kept the armed struggle outside the borders of the country.

Three events heralded in a period of instability at the end of Policy Paradigm III. The military coup in Portugal had the effect of changing the regional balance of power by converting the Wars of Liberation in Angola and Mozambique into power vacuums (Turner, 1998; Turton, 2006). The Yom Kippur War in Israel (October 1973) triggered a global oil crisis (Turton et al., 2004). The Soweto Riots took place on 16 June 1976, leaving around 575 people dead in an act of violence reminiscent of the Sharpeville Massacre a decade and a half earlier (Spitz and Chaskalson, 2000; Welsh, 2000). These three events magnified each other, ending the era of the 'Long Economic Boom' (Geldenhuys, 1990; Ross, 1999) (see Figure 2).

Policy Paradigm III was characterized by the extraction of mineral wealth, using water as a strategic resource, in order to grow the economy rapidly for purposes of political survival. This saw the resource capture of minerals coincide with resource capture of water, becoming a key element of the South African Hydraulic Mission with a merging of the interests of the mining houses with the interests of the Apartheid state.

Oversight was weak with the two parties (industry and the state) becoming collaborators, with environmental degradation being ignored and the costs of mining being externalized onto an uninformed public (Adler et al., 2007a; 2007b). Under these circumstances there was no space for individual policy entrepreneurs.

3.4 Policy Paradigm IV: State Survival and Total Onslaught (1976 – 1994)

The policy instability phase triggering the emergence of Policy Paradigm IV was the internalization of the armed struggle, taking place on 16 June 1976 during the Soweto Riots ('C' in Figure 2). This started to push inflation into a realm where it became a driver of instability in its own right (see Figure 2) (Turton et al., 2004), transforming the external armed struggle into an internal struggle. Increasing levels of violence engulfed the entire country as the insurgency grew (Geldenhuys, 1984; Barber and Barratt, 1990; Nortje, 2003) (see Figure 3).

Water and mining policy must be understood against this strategic background. In March 1980 Prime Minister P.W. Botha made a speech announcing what he called a 'total national strategy', needed to protect South Africa from the 'total onslaught' being waged by local surrogates of the Soviet Union (Geldenhuys, 1984). The Total National Strategy saw the mobilization of South Africa's entire financial, natural and human resources on a war footing in an endeavor to thwart this perceived Total Onslaught (Frankel, 1984). Policy Paradigm IV was about state survival during the Total Onslaught period, so the Policy Monopoly that achieved this objective was to effectively protect the goose that laid the golden eggs. This translated into minimal oversight of the mining industry. A recent study of minutes from meetings of the FWRDWA and the SCTC has concluded that this lack of oversight allowed the mining

companies to maximize their profits by: (a) building in complex mechanisms that avoided liabilities; (b) countering any attempts by the state to regulate the industry; and (c) by externalizing costs wherever possible (Adler et al., 2007b). A lasting consequence of this has been the systematic externalization of costs onto an unwilling society (Adler et al., 2007a) that is relevant to the current situation and still left unresolved at the time of writing.

Policy Paradigm IV was therefore about state survival in which the gold mining industry was protected, because revenue streams were needed to finance the war against the armed struggle at a time of soaring inflation driven by a variety of factors. A coalition of two main parties arose, each connected by their common interest – an increasingly embattled and illegitimate state concerned only with its own survival, and an industry concerned only with profit maximization – emerging as Policy Monopoly II with the one core objective of protecting the goose that laid the golden eggs. As with Policy Paradigm III there was no space for individual policy entrepreneurs to act as change agents.

3.5 Policy Paradigm V: Redistribution of Wealth and Privilege (1994 – Present)

The key shock events that opened the policy window were both internal and external ('D' in Figure 2). Internally, the recognition that a military solution was simply not possible was being driven by a small but elite group of political insiders under the leadership of Dr. Neil Barnard of the National Intelligence Service (NIS) (Turton, 2006). Externally, the Battle of Cuito Cuanavale was the final hot confrontation of the Cold War in Africa, when Russian armored forces redeployed from Afghanistan into Angola, joined with Cuban reinforcements to the Angolan Armed Forces (FAPLA),

resulting in an epic battle that only the veterans seem to remember today (Turner, 1998; Nortje, 2003; Mills and Williams, 2006; Turton, 2006). The tactical defeat of FAPLA allowed the emergence of a climate of negotiations, with the Convention for a Democratic South Africa (CODESA) convening for the first time on 20 December 1991 to start the work of drafting an interim constitution. This was adopted after much bloodshed in the country (Spitz and Chaskalson, 2000), with South Africa teetering on the very abyss of full-scale civil war when on 11 March 1994, heavy fighting broke out in Mmabatho as armed forces under the broad banner of the Concerned South Africa Group (COSAG) attracted the intervention of the South African Defence Force (SADF) (Turton, 2006). This was the last military engagement of significance as South Africa started the transition from war to peace (see Figure 3).

[Insert Figure 3 here]

These shock events were extreme, but they were mitigated by far-reaching constitutional reform. Central to this was the scrapping of all Apartheid-related legislation. However, as an unintended consequence, all of the administrative and legal precedent needed for subsequent service delivery was lost (becoming a driver of the current unrest (Johnston and Bernstein, 2007; Dixon, 2008; Sibanda, 2008; Walker, 2008)). A major thrust of this reform was the nationalization of strategic resources that had been the subject of resource capture over the past century.

A few key pieces of legislation emerged. The Constitution (1996) enshrines the right of an individual to an environment that is not harmful to their health or wellbeing (Paragraph 24a of Chapter 2: Bill of Rights). Sustainable development is legislated in

Paragraph 24b of Chapter 2 of the Bill of Rights, by stating that the environment must be protected for the benefit of present and future generations through reasonable legislative and other measures that (a) prevent pollution and ecological degradation, (b) promote conservation and (c) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The public is granted the right of access to information in Paragraph 32 of Chapter 2 of the Bill of Rights.

Of great importance is Chapter 3 of the Constitution mandating co-operation between all government departments. This has major ramifications for the management of mine water and other environmental and health implications rising from the mining sector, given the privileged status of that industry under the Policy Paradigm of Extraction and manifest in Policy Monopoly I (simple extraction) and Policy Monopoly II (protecting the goose that laid the golden eggs). It is this constitutional element that creates the legal foundation for Policy Monopoly III, which is all about a changed architecture of governance, with a clear separation between government as regulator and industry as the object of regulation.

Reforming the Department of Water Affairs and Forestry (DWAF), the National Water Act (1998) nationalized water resources under private control (DWAF, 1996; 1997; de Coning and Sherwill, 2004). This places heavy emphasis on historic redress by using water as a vehicle for other reforms in society. Implicit in this is the land ownership issue arising from the inequity of the 1913 Native Land Act. Given that water gives land its value, by controlling water rights, it is believed that signals can be sent out precipitating a managed land reform process as well, avoiding the Zimbabwe-

styled economic meltdown that arose after land was nationalized and banks lost their collateral. Embedded in this legislation is the Polluter Pays Principle.

Reform on the mining side has been less dramatic. The Mineral and Petroleum Resources Development Act (Act 28) (2002) defines a residue stockpile, but as with the earlier Apartheid-era legislation, does not define mining waste, thereby exempting this from waste management practices deemed to be 'normal' for other industries. Mineral residue (i.e. 'waste') is considered to be a potential future source of minerals and therefore not waste (Godfrey et al., 2007). This gives the industry enormous protection, so the legacy of past inequity has not been addressed, despite calls for this from the Department of Environmental Affairs and Tourism (DEAT) (Oelofse, 2008). The Mine Health and Safety Act (Act 29) (1996) regulates the human environment underground, but exempts mineral residue from being defined as waste. This also reflects the Apartheid past, because the Hazardous Substances Act (Act 15) (1998) defines Group IV hazardous substances as being radioactive material outside a nuclear installation as defined by the Nuclear Energy Act (Act 46) (1999), leaving an undefined grey area around radioactivity produced from mining activities (Godfrey et al., 2007). The National Environmental Management Act (Act 107) (1998) requires remediation of environmental damage, while supporting the re-use of mineral waste, nullifying its classification as being waste. The National Environmental Management: Air Quality Act (Act 39) (2004) determines the management regime for dust and air pollution arising from mining. The National Nuclear Regulator (NNR) and the Nuclear Energy Act (Act 46) (1999) both recognize that mineral waste from gold and uranium mines might be radioactive (Godfrey et al., 2007).

Regarding economic reform, the main thrust is for economic growth to address historic inequity by means of redistribution. This process has evolved along three distinct lines. The first in the immediate post-Apartheid-era is the Reconstruction and Development Programme (RDP), which focuses on the initial needs for reconstruction in a society torn apart by more than a century of endemic violence (RDP, 1994). The second is the Growth, Employment and Redistribution (GEAR) program, which focuses on the need for rapid economic growth to make up the backlog of economic stagnation, caused by the violence of the internal struggle phase that heralded in Policy Paradigm IV, and the economic sanctions flowing from that time. The third is the Accelerated and Shared Growth Initiative for South Africa (ASGISA), based on first-order principles (human dignity, social equity, justice, fairness, democratic governance), substantive principles (sustainable use of resources, protection of ecosystem integrity, balance between development and protection), and process principles (integration, innovation, consultation, participation, phased implementation) (ASGISA, 2006).

4. Actors and Strategies of Transition Management

The net result of the legal and political reforms is that the strategic landscape in which mining is embedded has changed, but is still complex. For the first time in South African history, there is space for individual policy entrepreneurs to act as change agents. Using the five strategies of transition management postulated in this book as a conceptual lens, the South African case study offers some useful insights.

The opening of the policy 'space' in the immediate post-Apartheid period released five identifiable sets of policy entrepreneurs, each with different interests and thus strategies for transition management:

The Liberation Leaders created the legal, moral and logical foundation for the Policy Paradigm of Redistribution to act as a counter-balance to the Policy Paradigm of Extraction (see Figure 1). The most notable here are Nelson Mandela, who created a climate in which reconciliation could be a viable alternative to endemic violence; and Kader Asmal, who became the first democratically elected Minister of Water Affairs. It was under Kader Asmal's inspired leadership that the legal reform took place in the water sector (De Coning and Sherwill, 2004). It is significant that no policy entrepreneur of similar status and credibility was appointed to lead the mining sector, probably accounting for the disparity in policy reform between these two sectors. The strategy used here was the development of new ideas and embedding them in legislation. Significantly, policy reform in South Africa is driven by legislation, rather than having the final legislation reflect the outcome of an evolutionary process of policy reform, which is typically the case in most mature democracies.

The Mining Industry immediately sought to protect its vested interests when democracy came in 1994. Falling back on the experience gained from thirty years of self-regulation during Policy Paradigms III and IV, they had already prepared themselves by learning how to outmanoeuvre government attempts to regulate them (Adler et al., 2007b). They can be regarded as policy opponents and their strategy is based on destroying any evidence for liability and/or culpability. This has resulted, for example, in attempts to disband the FWRDWA and SCTC, because those two bodies have detailed minutes of past meetings and masses of data that can be used to apportion specific liability. The apparent logic is that if those data disappear, then so too does any evidence that might form the legal foundation of future litigation. One tactic has been for a specific mine, known to be a major polluter, to appoint Mariette Liefferink (see

below) as public participation manager to one of their operations, ostensibly to drive a new corporate social responsibility process, but then to control her by giving her an inadequate budget. Another tactic has been to attack the credibility of scientists challenging the *status quo* (Coetzee et al., 2006), most notably by dubbing this specific report as the 'Infamous 1214'.

Civil Society is emerging as a key policy entrepreneur (Van Eeden, 2007), deriving its energy from public opinion, inflamed by decades of abuse by both government and the mining industry, bent on retribution and the desire to hold 'perpetrators' accountable for human rights abuses (Avni, 2007a; 2007b; 2007c; Brown, 2007; Gosling, 2007; Groenewald, 2007). This sentiment is captured in one newspaper article, written in response to the governments proposal that the mines must clean up their own pollution, stating that, 'to ask the polluter to fix the mess [they had created] was like appointing a convicted paedophile to manage the orphanage' (Tempelhoff, 2007b). Under the doggedly persistent leadership of Mariette Liefferink (Eybers, 2007), an environmental activist and self-proclaimed whistle-blower, a range of NGO's are now taking on the issue of acid mine drainage (AMD) (Marshall, 2007b). Probably the most prominent of these NGO's, at least in a leadership sense, is the Federation for a Sustained Environment (FES), in which Mariette Liefferink plays a coordinating role. The strategy used here is coalition building and the selling of new ideas. Other NGO's include the Wonderfontein Action Group (WAG), the Potch Petitioners, the Randfontein Environmental Action Group (REAG) and the Public Environmental Arbiters (PEA). Given the radioactivity aspect of gold-driven AMD, there is also a strong anti-nuclear component to this coalition. The main thrust of this coalition building is AMD, initially from the gold mining areas of the Far West Rand, thus being

associated with the thirty years of activity of the FWRDWA and SCTC. Their tactic is to oppose attempts to disband these two institutions and to preserve the data as public documents commensurate with the Constitutional imperative of public access to information. They rely heavily on scientific outputs from the epistemic community (dealt with below), and are avid consumers of this information. Their coalition activities are now spreading to embrace communities affected by coal-driven AMD, which has a slightly different chemistry, but affects a larger geographic extent of the country (Hobbs et al., 2008). The main thrust of civil society is liability, with a case being made for the prosecution of directors of mine companies, and/or senior civil servants, for failing to meet the constitutional mandate of providing an environment that is safe (Marshall, 2007a; Tempelhoff, 2007a). The advocate being used is a heavy hitter, having represented Nelson Mandela on many occasions, so his credibility is similar to that of the Liberation Leaders noted above. They have successfully linked water to politics however (Mmemezi, 2008; Nyathi, 2008; Secretary to Parliament, 2007), tapping into the broader political energy of failing service delivery (Dixon, 2008; Johnston and Bernstein, 2007; Sibanda, 2008). Significantly, civil society as policy entrepreneur shows no signs of recognizing the government's economic development policies, most notably ASGISA (2006).

The Epistemic Community is emerging as a major actor, with two specific national science councils and one university being directly involved. The first is the Council for Geosciences (CGS), which has played a leading role in generating the first high confidence peer reviewed public domain reports indicating that AMD is associated with radionuclide and heavy metal contamination (Coetzee, 1995; Coetzee et al., 2002a; 2002b; 2005; Wade et al., 2002). The most important of these has undoubtedly been the

so-called 'Report 1214' (Coetzee et al., 2006), which can be regarded as being a pivotal document, given the fundamental way that it has changed the policy debate. This pioneering work has been eagerly taken up by civil society who have actively popularized it (Avni, 2007a; 2007b; 2007c; Brown, 2007; Carte Blanche, 2007; Gosling, 2007; Groenewald, 2007) even in the international media (IRIN, 2008). The second is the Council for Scientific and Industrial Research (CSIR), which was slow to react initially, but once the CGS research had been published, the CSIR became deeply involved. The CSIR work is focused on two specific areas of perceived scientific importance. The first is the need to build scientific capacity to conduct the first national level epidemiological study of people potentially affected by radionuclide and heavy metal contamination using human deciduous teeth as specimens (the so-called Tooth Fairy Project) (CSIR, 2008). To date efforts have failed to bring the Medical Research Council (MRC) on board, ostensibly because of their own lack of capacity. Central to this is the need to build national capacity around water quality management, specifically arising from AMD, but also related to human health in a population that has the highest burden of HIV/AIDS in the world. This is being developed into a proposed National Water Quality Science, Technology and Policy Program (Turton, 2008). The North West University has also played a leading role (Winde and van der Walt, 2004; Winde, 2005). The strategy used by the epistemic community has been the development of a more robust scientific platform on which the new ideas inherent to the Policy Paradigm of Redistribution can be operationalized, thereby hoping to build on the efforts of the Liberation Leaders noted above by putting their constitutional ideals into sustainable practice. Significantly, the CSIR recognizes the governmental economic policy (ASGISA, 2006), but also recognizes the constitutional imperatives of human rights and

cooperative government (Turton, 2008). Attempts at coalition building by the epistemic community are hampered by the civil society insistence on liability for the mines, their failure to recognize the need for economic development, and their insistence that there have been too many reports generated and not enough 'action'. There is some convergence between the CSIR and the needs of local government, specifically with respect to the Tooth Fairy Project (Mmemezi, 2008; Smillie, 2008), brokered by the FES (the civil society actor noted above).

Research Funders are important policy agents. The Water Research Commission (WRC) is a statutory body, created by the Commission of Enquiry into Water Matters in 1966 (RSA, 1970; Turton et al., 2004) and mandated to fund strategic water research. The WRC opened up public funding to research that had previously been classified and thus out of the public domain. The first known work relevant to this analysis was on human health implications from groundwater (Toens et al., 1999). Other significant projects include 'Report 1095' (Wade et al., 2002) that developed a methodology for the assessment of radioactivity in sediment of rivers downstream of gold mining activities. Undoubtedly the most important is 'Report 1214' (Coetzee et al., 2006), which can now be considered a pivotal document of the same calibre as the Jordaan Commission of Enquiry (Jordaan et al, 1960) and the Commission of Enquiry into Water Matters in 1966 (RSA, 1970) by virtue of the impact it is likely to have on policy reform. The WRC is currently considering funding the Tooth Fairy Project (CSIR, 2008; Smillie, 2008), which will again be a national first if the funding is allocated. The strategy used by the WRC is merely to support initiatives developed by the epistemic community, so it is not an agenda setter in the policy field. Its role is thus important but benign. When approached the WRC has been willing to support ground

breaking (and hence potentially controversial) research projects, most notably 'Report 1214'. They are hampered by the non-existence of a coherent national response to AMD, so the CSIR is trying to help with the development of the proposed National Water Quality Science, Technology and Policy Program (Turton, 2008).

4. An Assessment of These Strategies

An assessment of the strategies for transition management used by the various change agents reveals an absence of any evolution beyond the first two phases of developing new ideas and building coalitions. This is significant, because while different actors show different forms of policy entrepreneurship, none have yet managed to reach a point where fundamental policy change has occurred, entrenching the status quo.

Having noted this limitation, there are at least four significant areas of either convergence or divergence that can be identified.

Leadership of the caliber of the Liberation Leaders noted above is a limitation. Their contribution was to establish a foundation for the Policy Paradigm of Redistribution and to create Policy Monopoly III, but the absence of inspired leadership on a continual basis has limited the impact that this policy reform could have had. Instead, the ruling party has become mired in corruption scandals (Feinstein, 2007), most notably over the acquisition of a large arms shipment, the repercussions of which are still reverberating around the country, to the point that the second democratically elected President, Thabo Mbeki, was removed from office on 20 September 2008. This has diverted resources and attention from policy reform, creating a crisis of service delivery, including the national energy crisis that brought the economy to a halt in 2008.

Government Restructuring has happened so many times in succession since the transition to democracy in 1994, that some government departments are no longer capable of meeting their mandate for service delivery (see Johnston and Bernstein, 2007; Nyathi, 2008). This restructuring has had a range of unintended consequences, one of which has been the loss of scientific capacity in the CSIR because of an inappropriate funding model (Walwyn and Scholes, 2006). This has eroded the capacity of the CSIR to generate the technical solutions needed to solve the AMD problems facing the country today. There are concerted efforts to change this situation however, with plans being tabled to create enough synergy to rebuild the lost capacity (Turton, 2008). Significantly, the mooted National Water Quality Science, Technology and Policy Program has a significant policy support dimension to it, so if it is approved by government, then new energy can be injected into the policy reform process.

The Epistemic Community has demonstrated its willingness to take a leadership role in policy reform by generating high quality science (capacity constraints notwithstanding) that is mostly uncontested and thus useful as a foundation for transition. In this regard the contribution of the CGS has been significant by producing ‘Report 1095’ and ‘Report 1214’. The CSIR, arriving belatedly in the policy arena, has tried to do this in a coherent and responsible manner (Godfrey et al., 2007; Adler et al., 2007a; 2007b; Hattingh et al., 2007; Hobbs and Cobbing, 2007; Smillie, 2007; CSIR, 2008; Hobbs et al., 2008; Mmemezi, 2008; Oelofse, 2008; Turton, 2008). Mixed signals are being sent out by other change agents however, most notably from civil society, who are calling for ‘action’ and a cessation of what they perceive to be an endless stream of reports and ‘worthless’ research. What the civil society actors fail to recognize is that many of the previous reports have been generated by consultants paid to protect

the status quo. What is lacking is credible, high impact science that shifts the factual basis on which policy reform should be based. So while it is true that there has been a plethora of reports about the Wonderfontein Spruit, for example, few of these have been structured in a way that moves the policy debate forward, with the only exception of 'Report 1095', 'Report 1214' and possibly the 'externalization of costs model' that shows how mines have maximized profits by shifting their costs for environmental rehabilitation onto society (Adler et al., 2007a). This mixed signal is hampering the attempts by the CSIR to get the Tooth Fairy Project funded (CSIR, 2008), because some potential funders are saying that civil society does not want more research.

The Right of Access to Information poses a specific dilemma. The epistemic community has many reports, papers, dissertations and other scientific literature in their archives that are restricted (classified) by virtue of previous funding agreements. Some of these indicate that both government and the mining industry were aware of the existence of radioactivity and heavy metals in AMD long before this was public knowledge (Avni, 2007a). This poses a major dilemma that is hampering policy reform, because the knowledge in that literature might be used in litigation against perceived 'perpetrators of human rights abuses'. This creates a climate of uncertainty for scientists, hesitant at being embroiled in possible litigation, and industry leaders, hesitant to invest money in research for solutions for fear of bringing the past into the present and future. It is unclear at this stage what would happen if a subpoena were to be issued to any member of the epistemic community to provide access to literature known to be in their possession.

5. The Resultant Policy Dynamics

The dynamics of Policy Paradigm V are being driven by two incompatible forces. The Policy Paradigm of Extraction, which has a long history of human rights abuse and even corruption, is being manifest as Black Economic Empowerment (BEE), with a small group of super-rich elites benefiting, but also at growing cost to the recently enfranchised working class, often worse off than before because of a failure in service delivery. This bears an uncanny resemblance to the earlier phases where elites colluded in order to protect their own self-interest. An important manifestation of this is the slow but deliberate movement of the head offices of major mining houses offshore, possibly as a strategic drive to distance themselves from the environmental and human health liabilities that are likely to arise from mine closure. This conclusion is speculative but not implausible. The second major force is focused on human rights and manifesting as the embryonic Policy Paradigm of Redistribution. It is the moral high ground inherent to this paradigm that is being used by the NGO community to attack government on their perceived policy failures. Driven by these two incompatible policy paradigms is Policy Monopoly III, which is incoherent at the time of writing. The incoherence is a manifestation of the incompatibility of the two competing policy paradigms. Is the main focus of the emerging Policy Monopoly III to be economic growth, self-enrichment and corruption of the gate-keeping elite? Or is it to be a genuine redistribution of wealth and privilege in a society so long exploited? The answer to this is far from clear. The growing unrest in Khutsong, along with the recent wave of xenophobic rioting that occurred in response to failed immigration policies and poor service delivery, is acting as a crucible in which these burning questions are being brought into vigorous frictional agitation (Johnston and Bernstein, 2007; Dixon, 2008; Nyathi, 2008; Sibanda, 2008; Turton, 2008; Walker, 2008).

Arising from the tension between these two policy poles are reforms rotating around four main axes:

The Issue of Liability arising from human health and environmental damage caused by a century of mining is significant. One response to this is the movement of the centre of gravity of major mining operations offshore. Another response is a set of cosy deals under the banner of BEE that seek to entrench the *status quo* as far as possible, but under a new collusion. Yet another is a lukewarm response to the Tooth Fairy Project, which might well find radioactivity and heavy metal contamination in off-mine communities, triggering liability claims.

The Classic Transboundary Problem about whose rules apply when water crosses a jurisdictional boundary is also relevant. This is manifest in the issue of the definition of mine waste in which the Department of Minerals and Energy (DME) is likely to push for a maintenance of the status quo and keep mine waste as a 'separate' issue under their sole jurisdiction. This is likely to see the DEAT as the line department responsible for 'normal' pollution and specifically wetlands, sidelined in all key areas where mine interests are concerned. The NNR has shown its willingness to act as a broker, bringing these factions together in a way that ensures their compliance with the cooperative governance mandate in the national Constitution. These efforts are being undermined by the political instability arising from the corruption scandal known as the 'Arms Deal' (Feinstein, 2007), which has seen high level casualties such as the sacking of President Thabo Mbeki on 20 September 2008, making many fearful officials reluctant to take the lead.

The Sustainable Development Debate centers on the question of what it actually means to develop in a sustainable manner? Central to this is balance between resource

use and resource protection, but always with the constitutional imperative of human rights in the background. A key element of this is oversight in a country with no entrenched culture of governance (Hattingh et al., 2007). The CSIR has taken the lead by developing what it calls 'sustainability science' (Burns et al., 2006; Burns and Weaver, 2008), which now needs to be operationalized into policy reform (Turton, 2008).

The Role of Science and Technology with the CSIR acting in partnership with stakeholders to develop technical solutions to the problems of AMD is now critical (Hobbs and Cobbing, 2007; Hobbs et al., 2008; Turton, 2008). While the West Rand AMD decant is significant, the next major event is predicted for the East Rand, so what is potentially learned during the former can be applied proactively to the latter. The predicted total decant of AMD in the Gauteng area is around 400 megalitres a day, so the volume is large and the impact significant, if left unmanaged. Driven by the existing West Rand AMD decant, a new company has been formed with the sole objective of developing a new water utilities corporation (Theunissen, 2008). This is designed to centralize the bad quality water, stripping it of its radioactivity and heavy metals and then selling it on to industries that need non-potable process water. The heavy metals harvested are projected to be significant in their value, so this revenue will be used to pay for the treatment after the mines close down. The public is skeptical of this however, because they are tired of being abused by the mining industry, so the rollout of the process will be a major challenge, needing a fusion of technology, finance, public relations and governance to succeed. CSIR technology, arguably more trusted than most, is probably an essential element of success.

6. Conclusion

The South African gold mining and water sectors offer a rich history of policy continuity and change where resource capture has been a dominant force. There is a history of major human rights abuses going back centuries, with three of the dominant social groupings having been literally decimated by the British at some moment in historic time. These three groups – the amaXhosa, amaZulu and Afrikaners – have all tried to rise again, but their communal memory of violence and human rights violation is a constant barrier to the emergence of a just society as claimed by the democratic Constitution in 1996. The failure to adequately deal with this history legacy has prevented the evolution of strategies for transition management beyond the second phase of coalition building. Where the current process of policy reform will take us, nobody really knows. Will the Policy Paradigm of Extraction merely corrupt the next generation of political elites at the expense of the long-oppressed masses as the Khutsong case suggests (Johnston and Bernstein, 2007)? Or will the Policy Paradigm of Redistribution build on the moral high ground and create a society that is just for the first time in the 350 turbulent years of modern South African history? What about national assets that are in state hands but generating private wealth? Will funding constraints hamper the generation of science capable of supporting policy reform in a sustainable way (Walwyn and Scholes, 2006; Turton, 2008)? These are complex issues, so only time will tell, because the jury is still out and the dynamics are too fluid to predict with any confidence.

References

Adler, R.A., M. Claassen, L. Godfrey and A.R. Turton (2007a), 'Water, Mining

and Waste: An Historical and Economic Perspective on Conflict Management in South Africa', *The Economics of Peace and Security Journal*, **2** (2), 32-41.

Adler, R., N. Funke, K. Findlater and A.R. Turton (2007b), *The Changing Relationship between the Government and the Mining Industry in South Africa: A Critical Assessment of the Far West Rand Dolomitic Water Association and the State Coordinating Technical Committee*, Pretoria, Council for Scientific and Industrial Research (CSIR).

ASGISA (2006), *People – Planet – Prosperity: A Strategic Framework for Sustainable Development in South Africa*, Pretoria, Department of Environmental Affairs and Tourism (DEAT).

Avni, J. (2007a), 'Lives at Risk: State Knew About Danger for 40 Years', *Sowetan Newspaper*, 24 July 2007.

Avni, J. (2007b), 'Report Exposes High Water Contamination', *Sowetan Newspaper*, 3 August 2007.

Avni, J. (2007c), 'Poisoned by Mines', *Sowetan Newspaper*, 20 August 2007.

Barber, J. and J. Barratt (1990), *South Africa's Foreign Policy: The Search for Status and Security, 1945 – 1988*, Cambridge, Cambridge University Press.

Basson, M.S., P.H. van Niekerk and J.A. van Rooyen (1997), *Overview of Water Resources Availability and Utilization in South Africa*, Pretoria, Department of Water Affairs and Forestry.

Brown, J. (2007), Derelict Mines to Cost State R100bn, *Business Report*, 23 May 2007.

Burns, M., M. Audouin and A. Weaver (2006), 'Advancing Sustainability Science in South Africa', *South African Journal of Science*, **102**, 379-384.

Burns, M.J. and A.v.B. Weaver (eds.) (2008), *Advancing Sustainability Science in South Africa*, Stellenbosch, Stellenbosch University Press.

Carte Blanche (2007), Environment and Conservation, Presenter Devi Sankaree, Producer Carol Albertyn, M Net TV Program, 12 August 2007.

Coetzee, H. (1995), 'Radioactivity and the Leakage of Radioactive Waste Associated with Witwatersrand Gold and Uranium Mining', in B. Merkel, S. Hurst, E.P. Löhnert, and W. Struckmeier (eds.), *Proceedings of the International Conference and Workshop in Freiberg, Germany*, October 1995.

Coetzee, H., P. Wade, G. Ntsume and W. Jordaan (2002a), *Radioactivity Study on Sediments in a Dam in the Wonderfonteinspruit Catchment. DWAF Report*, Pretoria, Department of Water Affairs and Forestry.

Coetzee, H., P. Wade and F. Winde (2002b), 'Reliance on Existing Wetlands for Pollution Control Around the Witwatersrand Gold/Uranium Mines in South Africa – Are They Sufficient?', in B.J. Merkel, B. Planer-Friederich and C. Wolkersdorfer (eds.) (2002), *Uranium in the Aquatic Environment*, Berlin, Springer, pp 59-65.

Coetzee, H., J. Venter and G. Ntsume (2005), *Contamination of Wetlands by Witwatersrand Gold Mines – Processes and the Economic Potential of Gold in Wetlands. Council for Geosciences Report No. 2005-0106*, Pretoria, Council for Geosciences.

Coetzee, H., F. Winde and P.W. Wade (2006), *An Assessment of Sources, Pathways, Mechanisms and Risks of Current and Potential Future Pollution of Water and Sediments in Gold-Mining Areas of the Wonderfonteinspruit Catchment*, WRC Report No. 1214/1/06, Pretoria, Water Research Commission.

Conley, A.H. (1996), 'A Synoptic View of Water Resources in Southern Africa', in H. Solomon (ed.) (1996), *Sink or Swim? Water, Resource Security and State Co-operation*, IDP Monograph Series, pp 17-69.

Constitution (1996), *The Constitution of the Republic of South Africa*, Act 108 of 1996, Pretoria, Government Printer.

CSIR (2008), *High Confidence Study of Children Potentially Affected by Radionuclide and Heavy Metal Contamination Arising from the Legacy of Mine Water Management Practices on the Far West Rand of South Africa*, Project Concept Note, dated 26 february 2008, Pretoria, Council for Scientific and Industrial Research (CSIR).

De Coning, C. and T. Sherwill (2004), *An assessment of the water policy process in South Africa (1994 to 2003)*, Water Research Commission Report TT232/04, Pretoria, Water Research Commission.

Dixon, R. (2008), 'Migrants Targeted for Fiery Deaths in South Africa', *Los Angeles Times*, 20 May 2008.

Du Toit, A. (1994), 'Fragile Defiance: The African Resistance Movement', in I. Liebenberg, F. Lortan, B. Nel and G. van der Westhuizen (eds.), *The Long March: The Story of the Struggle for Liberation in South Africa*, Pretoria, HAUM, pp. 96-103.

DWAF (1996), *Discussion Document on Water Law Principles*, Pretoria, Department of Water Affairs and Forestry.

DWAF (1997), *White Paper on Water Policy. South Africa*, Pretoria, Department of Water Affairs and Forestry.

Edgecombe, R. (1986), 'The Mfecane or Difaqane', in T. Cameron and S.B. Spies (eds.), *New History of South Africa in Word and Image (Afrikaans)*, Cape Town, Human and Rousseau.

Eybers, T. (2007), 'SA 'Erin' Widens Toxic Water Fight: Water Too Dangerous for Farming', *The Citizen*, 14 August 2007.

Farwell, B. (1999), *The Great Boer War*, London, Wordsworth Editions.

Fawcett, M.H. (1901), *The Concentration Camps in South Africa*, London, Westminster Gazette.

Feinstein, A. (2007), *After the Party: A Personal and Political Journey inside the ANC*, Johannesburg, Jonathan Ball.

Frankel, P.H. (1984), *Pretoria's Praetorians: Civil-Military Relations in South Africa*, London, Cambridge University Press.

Geldenhuys, D. (1984), *The Diplomacy of Isolation: South African Foreign Policy Making*, Johannesburg, Macmillan South Africa.

Geldenhuis, D. (1990), *Isolated States: A Comparative Analysis*, Johannesburg, Jonathan Ball Publishers.

Godfrey, L., S. Oelofse, A. Phiri, A. Nahman and J. Hall (2007), *Mineral Waste: The Required Governance Environment to Enable Reuse. Report No. CSIR/NRE/PW/IR/2007/0080/C*, Pretoria, Council for Scientific and Industrial Research (CSIR).

Gosling, M. (2007), 'The Environmental Impact of Uranium Waste', *Cape Times*, 25 June 2007.

Groenewald, Y. (2007), 'SA's Eco-prophecy', *Mail and Guardian*, 26 July 2007.

Hasian, Marouf (2003), 'The "hysterical" Emily Hobhouse and Boer War Concentration Camp controversy', in *Western Journal of Communication*, March 2003, Available online at Website http://www.accessmylibrary.com/coms2/summary_0286-23546431_ITM (last visit November 2008)

Hattingh, J., G.A. Maree, P.J. Ashton, J. Leaner, J. Rascher and A.R. Turton (2007), 'A Trialogue Model for Ecosystem Governance', *Water Policy*, **9** (2), 11-18.

Hazardous Substances Act. (1998), *The Hazardous Substances Act*, Act 15 of 1998, Pretoria, Government Gazette.

Hobbs, P.J. and J.E. Cobbing (2007), *A Hydrogeological Assessment of Acid Mine Drainage Impacts in the West Rand Basin*, Gauteng Province, Rep. no.

CSIR/NRE/WR/ER/2007/0097/C, CSIR/THRIP, Pretoria, Republic of South Africa.

Hobbs, P., S.H.H. Oelofse and J. Rascher (2008), 'Management of Environmental Impacts from Coal Mining in the Upper Olifants River Catchment as a Function of Age and Scale', in M.J. Patrick, J. Rascher and A.R. Turton (eds.), 'Reflections on Water in South Africa', Special Edition of *International Journal of Water Resource Development*, **24** (3), 417-432.

Hobhouse, E. (1901), *Report of a Visit to the Camps of Women and Children in the Cape and Orange River Colonies*, London, Friars Printing Association Ltd.

IRIN (2008), 'South Africa: Paying the Price for Mining', UN Office for the Coordination of Humanitarian Affairs, *IRIN Humanitarian News and Analysis*.

Available online at <http://www.irinnews.org/Report.aspx?ReportId=76780> (last visit November 2008)

Johnston, S. and A. Bernstein (2007), *Voices of Anger: Protest and Conflict in Two Municipalities. Report to the Conflict and Governance Facility (CAGE)*,

Johannesburg, The Centre for Development and Enterprise.

Jordaan, J.M., J.F. Enslin, J.P. Kriel, A.R. Havemann, L.E. Kent and W.H. Cable (1960), *Finale Verslag van die Tussendepartmentele Komitee insake Dolomitiese Mynwater: Verre Wes-Rand, Gerig aan sy Edele die Minister van Waterwese deur die Direkteur van Waterwese*, (In Afrikaans translated as, Final Report of the Interdepartmental Committee on Dolomitic Mine-water: Far West-Rand, Directed at His Excellency the Minister of Water Affairs by the Director of Water Affairs), Pretoria, Department of Water Affairs.

Kempster, P.L., H.R. Van Vliet, U. Looser, I. Parker, M.J. Silberbauer and P. Du Toit (1996), *Overview of Radioactivity in Water Sources: Uranium, Radium and Thorium. Final Report*, IWQS-No:N/0000/00/RPQ/0196, Pretoria, Institute for Water Quality Studies.

Kleyweght, R.J. and D.R. Pike (1982), 'Surface Subsidence and Sink-holes Caused by Lowering the Dolomitic Table on the Far West Rand Gold Field of South Africa', *Annual Geological Survey of South Africa*, **16**, 77-105.

Krebs, P.M. (1992), "'The Last of the gentleman's wars': Women in the Boer War concentration camp controversy', *History Workshop Journal*, **33**, 38–56.

Liebenberg, B.J. (1987), "Botha and Smuts' Rule, 1910 – 1924", in C.F.J. Muller (ed.), *Five Hundred Year: South African History*, Pretoria, Academica.

Liebenberg, I. (1994), 'Resistance by the SANNC and the ANC, 1912 – 1960', in I. Liebenberg, F. Lortan, B. Nel and G. van der Westhuizen (eds.), *The Long March: The Story of the Struggle for Liberation in South Africa*, Pretoria, HAUM, pp. 8-21.

Lodge, T. (1994), 'The Pan-Africanist Congress, 1959-1990', in I. Liebenberg, F. Lortan, B. Nel and G. van der Westhuizen (eds.), *The Long March: The Story of The Struggle for Liberation in South Africa*, Pretoria, HAUM, pp. 104 - 124.

Marshall, L. (2007a), 'Top Lawyer Joins Forces with Greens', *Sunday Tribune*, 9 September 2007.

Marshall, L. (2007b), 'New Alliance to Fight Environmental Degradation', *Sunday Independent*, 9 September 2007.

Meer, F. (1990), *Higher than Hope*, London, Harper Collins.

Mills, G. and D. Williams (2006), *Seven Battles that Shaped South Africa*, Cape Town, Tafelberg.

Mmemezi, H.M.Z. (2008), Official letter of support from the West Rand District Municipality under reference 12/2/1/3 dated 12 May 2008 entitled Epidemiological Study: Tooth Fairy Project, signed by Councillor Mmemezi in his capacity as Portfolio Chairperson, Infrastructure.

Mine Health and Safety Act (1996), *The Mine Health and Safety Act*, Act 29 of 1996, Pretoria, Government Gazette.

Mineral and Petroleum Resources Development Act (2002), *The Mineral and Petroleum Resources Development Act*, Act 28 of 2002, Pretoria, Government Gazette.

Muller, M. (2007), 'DG Reports: A View from the Other Side', *Weekly Mail and Guardian*, 20 November 2007. Available online at

http://www.mg.co.za/articlePage.aspx?articleid=325301&area=/insight/insight_content_and_analysis/ (last visit November 2008).

National Environmental Management Act (1998), *The National Environmental Management Act*, Act 107 of 1998, Pretoria, Government Gazette.

National Environmental Management: Air Quality Act (2004), *The National Environmental Management: Air Quality Act*, Act 39 of 2004, Pretoria, Government Gazette.

National Water Act (1998), *The National Water Act*, Act 36 of 1998, Pretoria, Government Gazette.

NNR (2007), *Radiological Impacts of the Mining Activities to the Public in the Wonderfonteinspruit Catchment Area*, Report No. TR-RRD-07-0006, Pretoria, National Nuclear Regulator.

Nortje, P. (2003), *32 Battalion*, Cape Town, Struik Publishers.

Nuclear Energy Act (1999), *The Nuclear Energy Act*, Act 46 of 1999, Pretoria, Government Gazette.

NWRS (2004), *National Water Resource Strategy*. Pretoria, Department of Water Affairs and Forestry (DWAF).

<http://www.dwaf.gov.za/Documents/Policies/NWRS/Default.htm> (last visit November 2008)

Nyathi, S. (2008), 'No Water – No Vote', *News 24*, Accessed Online

http://www.news24.com/News24/South_Africa/News/0,,2-7-1442_2326211,00.html

(last visit November 2008)

Odendaal, A. (1994), 'The Roots of the ANC', in I. Liebenberg, F. Lortan, B. Nel and G. van der Westhuizen (eds.), *The Long March: The Story of the Struggle for Liberation in South Africa*, Pretoria, HAUM, pp. 1–7.

Oelofse, S.H.H. (2008), *Mine Water Pollution – Acid Mine Decant, Effluent and Treatment: Consideration of Key Emerging Issues that may Impact the State of the Environment*, Pretoria, Department of Environmental Affairs and Tourism (DEAT), Available online at <http://soer.deat.gov.za/docport.aspx?m=97&d=28> (last visit November 2008)

Pakenham, T. (1992), *The Boer War*, London, Harper Perennial.

Peires, J. (2003), *The Dead Will Arise. Nongqawuse and the Great Xhosa Cattle Killing of 1856-7. History of Political Thought*, Johannesburg, Jonathan Ball Publishers (Pty) Ltd.

RDP (1994), *The Reconstruction and Development Programme: A Policy Framework*, Johannesburg, African national Congress, Umanyano Publications.

Ross, R. (1999), *A Concise History of South Africa*, Cambridge, Cambridge University Press.

RSA (1970), *Report of the Commission of Enquiry into Water Matters. Document No. R.P. 34/1970*, Pretoria, Government Printer.

Secretary to Parliament (2007), *Internal Question Paper No. 28 of 2007. Question posed by Mr. G.R. Morgan (DA) to the Minister of Environmental Affairs and Tourism*, Cape Town, Hansard.

Smillie, S. (2008), 'Tooth Fairy Project May Reveal Effect of Uranium', *The Star*, 18 March 2008, pp 10.

Sibanda, B. (2008), 'Falling Economic Standards Cause Xenophobia in South Africa', *Afrik.com*, 14 May 2008.

Spitz, R. and M. Chaskalson (2000), *The Politics of Transition: A Hidden History of South Africa's Negotiated Settlement*, Johannesburg, Witwatersrand University Press.

Tempelhoff, J.W.N. (2003), *The Substance of Ubiquity: Rand Water 1903 – 2003*, Vanderbijlpark, Kleio Publishers.

Tempelhoff, E. (2004), 'Inwoners moet Weet van Giftige Gebied' (Residents must Know of Toxic Area), *Beeld Newspaper*, 10 August 2004.

Tempelhoff, E. (2007a), 'Myne Misken Menseregte, meen Bizos' (Mines Flout Human Rights, says Bizos), *Beeld Newspaper*, 11 September 2007.

Tempelhoff, E. (2007b), 'Mense en Omgewing Stik oor Goudwelvaart: Mynmonopoliese Gru-Moerass' (People and Environment Choke over Gold Wealth: Mine Monopoly's Gruesome Mess), *Beeld Newspaper*, 2 February 2007.

Tempelhoff, E. (2007c), 'Gif in die Water: Besoedeling Naby Goudmyne Bedreig Duisende, Besmet Voedsel' (Poison in the Water: Pollution Near Goldmines Threatens Thousands, Contaminates Food), *Beeld Newspaper*, 24 April 2007.

Theunissen, N. (2008), 'The Big Picture Solution – Acid Mine Drainage', *Water Sewage and Effluent*, **28** (5), 11–17.

Thompson, L. and H. Lamar (1981), The North American and Southern African Frontiers, in H. Lamar and L. Thompson (eds.), *The Frontier in History: North America and Southern Africa Compared*, New Haven and London, Yale University Press, 12 - 28.

Toens, P. D., W. Stadler and N.J. Wullschleger (1999), *The Association of Groundwater Chemistry and Geology with Atypical Lymphocytes (as a biological indicator) in the Pofadder Area, North Western Cape, South Africa. Water Research Commission, Report Number: 839/1/98*, Pretoria, Water Research Commission.

Turner, J.W. (1998), *Continent Ablaze: The Insurgency Wars in Africa 1960 to the Present*, Johannesburg, Jonathan Ball Publishers.

Turton, A.R. (2006), *Shaking Hands with Billy: The Private Memoirs of Anthony Richard Turton*, Limited Edition, Krugersdorp, JFA Printers.

Turton, A.R. (2007), *Can we solve Tomorrow's Problems with Yesterday's Experiences and Today's Science?*, Des Midgley Memorial Lecture presented at the 13th SANCIAHS Symposium, Cape Town, 6 September 2007.

Turton, A.R. (2008), *Three Strategic Water Quality Challenges that Decision-Makers Need to Know About and How the CSIR Should Respond*, CSIR Report No. CSIR/NRE/WR/EXP/2008/0160/A, Pretoria, Council for Scientific and Industrial Research (CSIR).

Turton, A.R., R. Meissner, P.M. Mampane and O. Seremo (2004), *A Hydropolitical History of South Africa's International River Basins*, Report No. 1220/1/04 to the Water Research Commission, Pretoria, Water Research Commission.

Turton, A.R., C. Schultz, H. Buckle, M. Kgomongoe, T. Malungani and M. Drackner (2006), 'Gold, Scorched Earth and Water, The Hydropolitics of Johannesburg', *International Journal of Water Resources Development*, **22** (2), 313-335.

Turton, A.R. and P.J. Ashton (2008), 'Basin Closure and Issues of Scale: The Southern African Hydropolitical Complex', *International Journal of Water Resources Development*, **24** (2), 305-318.

van Eeden, E.S. (1992), *Ekonomiese Ontwikkeling en die Invloed Daarvan op Carletonville, 1948 – 1988: 'n Historiese Studie* (Afrikaans translated as Economic Development and the Influence Thereof on Carletonville, 1948 – 1988: An Historic Study), PhD Thesis, Potchefstroom University for Higher Christian Education.

van Eeden, E.S. (2007), 'An Historical Assessment of NGO Efficiency in Progressing Towards a Sustainable Environmental Heritage Focus, with as Case Study the Wonderfontein Spruit Catchment, Gauteng', *New Contree*, **53**, 55–78.

Van Jaarsveld, F.A. (1975), *From Van Riebeeck to Vorster 1652-1974: An introduction to the History of the Republic of South Africa*, Johannesburg, Perskor Publishers.

Wade, P.W., S. Woodbourne, W.M. Morris, P. Vos and N.W. Jarvis (2002), *Tier 1 Risk Assessment of Selected Radionuclides in Sediments of the Mooi River Catchment*, WRC Project No. K5/1095, Pretoria, Water Research Commission.

Walker, P. (2008), 'South African Mobs Hunt Down Immigrants', *Guardian*, 19 May 2008.

Walwyn, D. and R.J. Scholes (2006), 'The Impact of a Mixed Income Model on the South African CSIR: A Recipe for Success or Disaster?' *South African Journal of Science*, **102**, 239-243.

Welsh, Frank (2000), *A History of South Africa*, London, Harper Collins Publishers.

Wermüller, V.W. (1986), 'The Central Rand', in E.S.A. Antrobus (ed.), *Witwatersrand Gold – 100 Years*, Johannesburg, The Geological Society of South Africa, pp 7-47.

Williams, R. (1994), *The Other Armies: Writing the History of MK*, in I. Liebenberg, F. Lortan, B. Nel and G. van der Westhuizen (eds.), *The Long March: The Story of the Struggle for Liberation in South Africa*, Pretoria, HAUM, pp 22 - 34.

Winde, F. (2005), 'Impacts of Gold-mining Activities on Water Availability and Quality in the Wonderfonteinspruit Catchment', in H. Coetzee (ed.), *An Assessment of Current and Future Water-pollution Risk with Application to the Mooirivierloop (Wonderfonteinspruit)*, WRC Report No. K5/1214, Pretoria, Water Research Commission, pp 14-38.

Winde, F. and I.J. van Der Walt (2004), 'The Significance of Groundwater-Stream Interactions and Fluctuating Stream Chemistry on Waterborne Uranium Contamination of Streams – A Case Study from a Gold Mining Site in South Africa', *Journal of Hydrology*, **287**, 178-196.

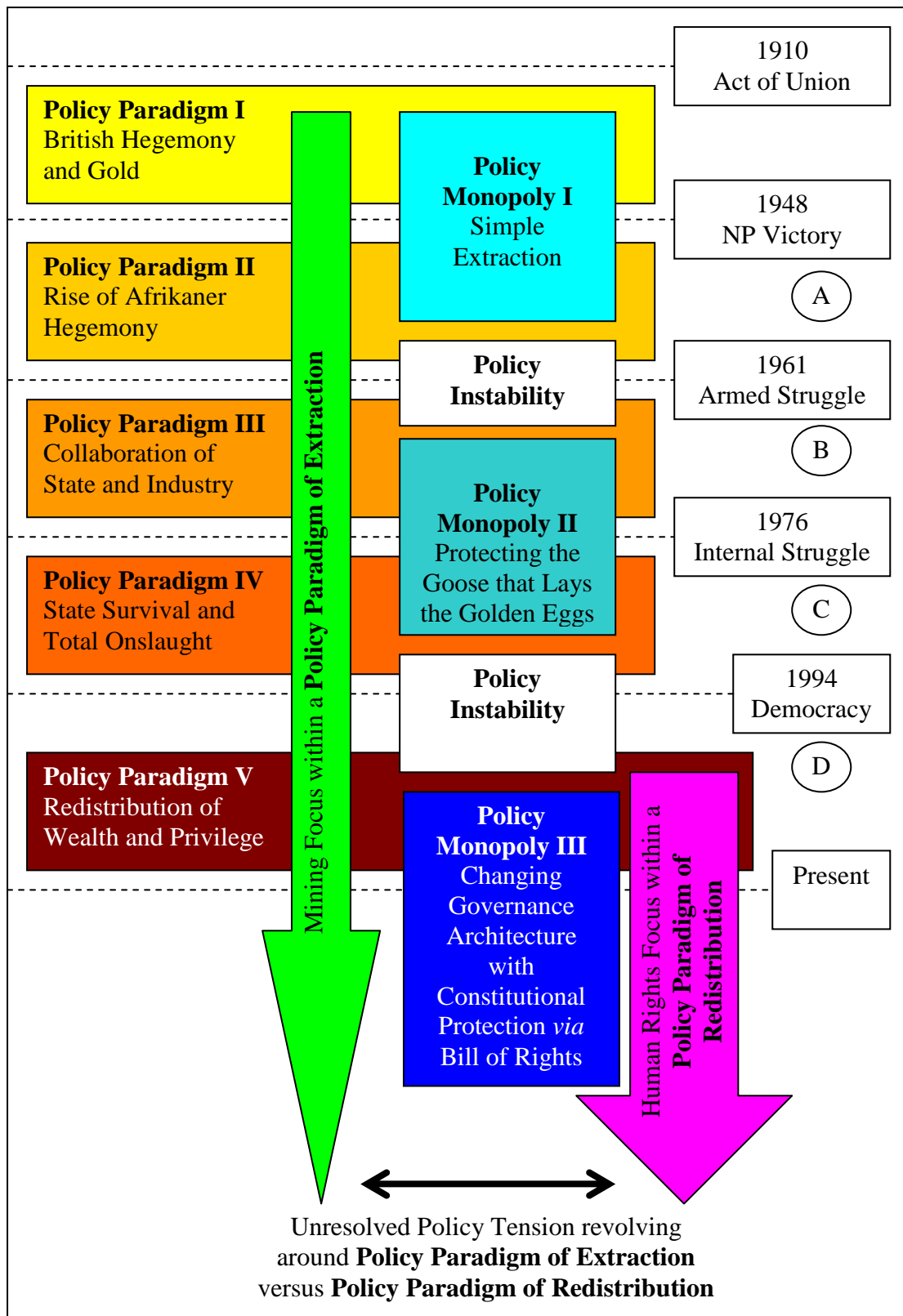


Figure 1: Schematic representation of the evolution of mining and water policy showing key transition periods. Refer to Figure 2 for comparison and linkage of the five Policy Paradigms to national economic inflation data.

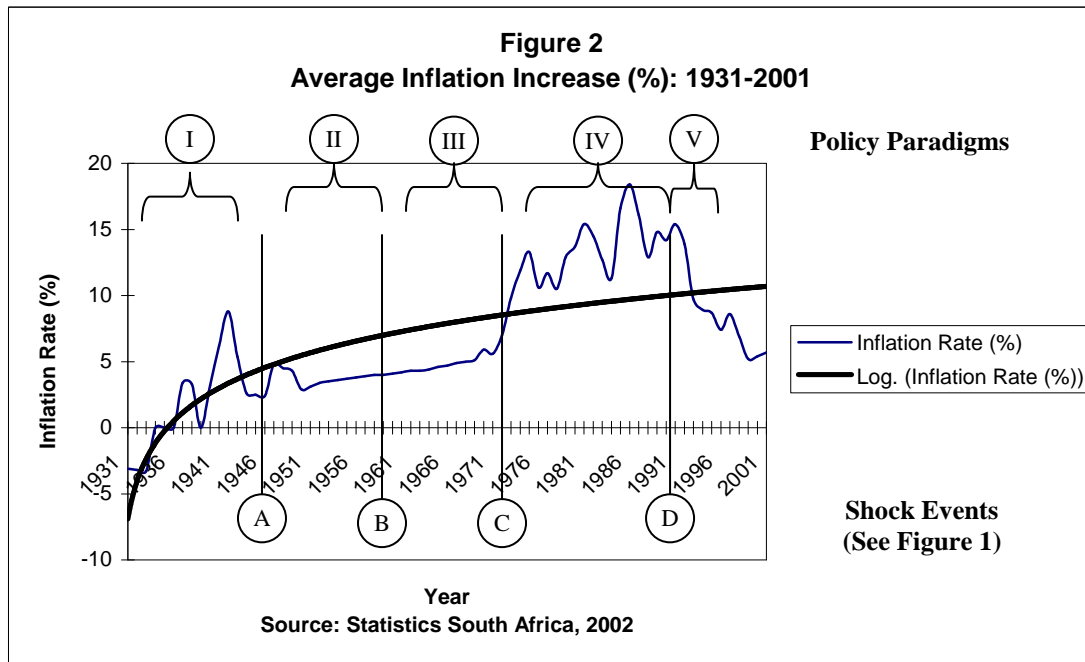


Figure 2: Inflation trends in South Africa track political instability (Turton *et al.*, 2004:74). During periods when inflation was above average there were periods of acute political conflict (1938 – 1945 and 1975 – 1994). Periods of below average inflation coincided with relative stability. The “Midas Touch” or “Long Economic Boom” period is visible as a below average inflation period from the early 1950’s to 1975. The vertical lines and alphabetical circles coincide with the Shock Events, and the numbered circles above the brackets coincide with the Policy Paradigms illustrated in Figure 1 and listed in the text.

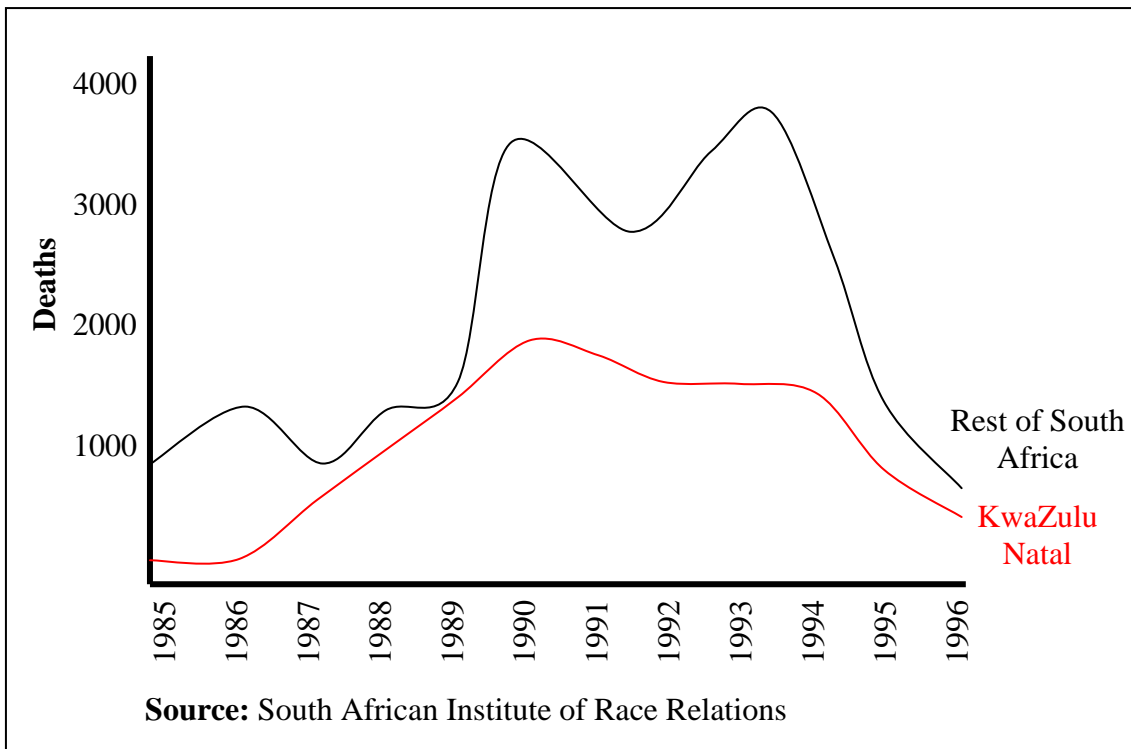


Figure 3. Graph showing the deaths by political violence in South Africa and KwaZulu Natal from 1985 to 1996 during Policy Paradigm IV (Turton, 2006: 232). KwaZulu Natal made a disproportionately large contribution to the national death toll. After the Battle of Mmabatho in 1994 (see text Turton, 2006 for more details) the violence tapered off dramatically as South Africa recoiled from the abyss of full-scale civil war.