



the federation for a sustainable environment

**Registration Number: 2006/217972/23**

**NPO NUMBER: 062986-NPO**

## **COMMENTS ON GDARD PROJECT: RECLAMATION OF MINE RESIDUE AREAS FOR DEVELOPMENT PURPOSES**

I respectfully request that the following comments be read in conjunction with my previous comments.

### **PRELIMINARY COMMENTS**

The opportunity and financial costs for unfunded non-governmental organizations (NGOs), civil society and interested and affected parties to attend and participate in steering committees and public participation processes and to comment intelligently and meaningfully on environmental projects are high. We therefore respectfully request that our comments will not be passed over.

We strongly recommend the perusal and incorporation of the findings and recommendations of the:

1. Department of Mineral Resources' Draft Regional Closure Strategies for the Witwatersrand goldfields. (2008);

2. “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.” H Coetzee *et al*, Council for Geoscience. 2004. Report No 1214/1/06;
3. NNR Report – TR-RRD-07-0006 – “Radiological Impacts of the Mining Activities to the Public in the Wonderfonteinspruit Catchment Area,” 12 July 2007;
4. “Status Report on the Actions Arising from the Study of Radiological Contamination of the Wonderfonteinspruit Catchment Area (WCA)”, 29 October 2007;
5. The Water Research Commission Report, 1215/1/05;
6. AngloGold Ashanti’s Environmental Impact Assessment Report for its West Wits Operations. 2009;
7. “Uranium Pollution of Water Resources in Mined-Out and Active Goldfields of South Africa – A Case Study in the Wonderfonteinspruit Catchment on Extent and Sources of U-Contamination and Associated Health Risks” F. Winde. 2009;
8. “Radiometric Surveying in the Vicinity of Witwatersrand Gold Mines”, H. Coetzee. Mine Closure 2008;
9. “Land-Use after Mine Closure – Risk Assessment of Gold and Uranium Mine Residue Deposits on the Eastern Witwatersrand, South Africa, M. W. Sutton, Mine Closure. 2008;
10. “South Africa’s Strategy for the Management of Derelict and Ownerless Mines.” H. Coetzee *et al*, Mine Closure 2008;
11. “Establishing a Framework for Intervention and Remediation of Radioactive Contamination from Gold Mining – Learning from the Past”, J.F. Ellis, Mine Closure 2008;

in your final Report.

## ISSUES OF CONCERN

The current reclamation of historic tailings storage facilities within the Upper Wonderfonteinspruit, the North West, Central and the East Rand goldfields for gold and uranium has significantly contributed to the contamination of surface water courses through tailings

spillages, dust and radioactivity from technologically enhanced naturally occurring radioactive materials (TECNORMs), soil and ground water contamination, and resulted in the remobilization of contaminants such as uranium and cyanide during disturbance of old tailings deposits. There is furthermore evidence of bioaccumulation of metals and TECNORMs, loss of biodiversity and impairment of ecosystems, and resultant human health impacts.

If we were to judge the future environmental impacts of the reclamation of tailings dams grounded upon the current environmental impacts and management of the reclamation of tailings dams, we have reason for serious concern.

The management of environmental impacts during the reclamation of historic tailings dams is poor. There are regular infringements by the operating mines of legally binding Environmental Management Programme Reports (EMPR) and non-enforcement of these environmental contraventions by the relevant organs of state. Monitoring of compliance has been cheaply outsourced to civil society and NGOs who are overwhelmed by the sheer magnitude of environmental infractions.

Footprints of re-mined tailings disposal facilities and re-mining operations are not fenced off and no warning signs are erected. Unauthorised entry onto mining sites and the removal of uranium-bearing tailings and radioactive infrastructure or scrap metal for construction material are common.



Unlawful removal of radioactive infrastructure from the ERPM Mine in the Central Rand goldfields

No buffer zones to human settlement, cropping and grazing have been defined and legally enforced around tailings dams, footprints of reclaimed tailings dams and residual contamination or for the uses of contaminated water (discharge, polluted streams and groundwater) for crop irrigation. Informal settlements, low cost housing and household food gardens are erected upon unrehabilitated footprints of re-mined tailings dams, exposing residents to elevated levels of toxic and radioactive heavy metals, including radon and radon gas. These residents are particularly vulnerable since they belong to sub-population groups with high HIV/Aids and chronic and acute malnutrition.

With reference to the Tudor Shaft Informal Settlement, one of many settlements that are established on the footprints of reclaimed tailings dams, Prof. Dr. Chris Busby<sup>1</sup>, found:

Prof. Dr Chris Busby

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Mariette Liefferink

By email

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<sup>1</sup> Prof. Busby has a First Class Honours degree in Physical Chemistry from the University of London and also holds a Doctorate in Chemical Physics. He was elected to the Royal Society for Chemistry in 1974 and he is presently a Member of the International Society for Environmental Epidemiology. He is a scientific reviewer for *The Lancet* and *The European Journal of Cancer*, *The Journal of Paediatric Radiology*, the *European Journal of Biology and Bioelectromagnetics* and *Science and Public Policy*

He has studied the health effects of low dose radiation for more than 15 years and conducted research both at the fundamental cell biology level and as a radiation epidemiologist. He has been a member of two UK government committees on this issue (Committee Examining Radiation Risks for Internal Emitters, CERRIE, and the Ministry of Defence Depleted Uranium Oversight Board). He also has officially advised government and other expert or investigative committees e.g. The Committee on Radioactive Waste Management (CORWM), the US Congressional Committee on Veterans Affairs and Security, The Royal Society, The House of Commons Enquiry into the health of A-Bomb veterans, and the European Parliament. He is an official expert witness for the Canadian Parliament on the health effects of Uranium. He was until 2008 a fellow of the University of Liverpool in the Faculty of Medicine and He is currently Visiting Professor of Radiation and Health in the Faculty of Life and Health Sciences (Department of Molecular Biosciences) of the University of Ulster in Northern Ireland where he is supervising PhD research on uranium photoelectron enhancement effects. He is also Guest Researcher at the Julius Kuhn Institute of the German Federal Agricultural Laboratories (FAL) in Brunswick near Hanover where he is examining the health effects of uranium exposure. I am Scientific Secretary of the European Committee on Radiation Risk (ECRR) based in Brussels (*Comite Europeen Sur Le Risque de l'Irradiation (CERI)*) and senior editor of its report *ECRR2003 Recommendations of the European Committee on Radiation Risk: The Health Effects of Ionising Radiation Exposure at Low Doses for Radiation Protection Purposes*. This report has now been translated into French, Russian, Japanese and Spanish and has been used for radiation protection purpose scoping by many organisations including most recently (2006) the UK Committee on Radioactive Waste Management (CORWM).

6<sup>th</sup> Dec 2010

Dear Mariette

This is to formally confirm that on Sunday 28 Nov 2010, I visited various sites with you and made measurements of beta/gamma radiation levels. The device was a Russian 2-chamber SOSNA beta gamma Geiger counter which I have checked against a UK officially calibrated Geiger counter over the dose range I was using it for. In the shack where I visited in the Tudor Shaft informal village the dose rate was 1110nSv/h which translates to 9.72mGy or mSv per annum. I measured the radiation at ground level over linoleum so the predominant dose would have been from gamma radiation. The mean background I measured away from the mining area (in the grounds of the hotel) was 180-200nGy/h so the shack dose from the contamination was about 8mSv per year. This does not include exposure to the radon, to inhalation or ingestion but is purely external dose.

The readings were higher than background in most of the places we visited where there were tailings or spoil. In the Tudor Dam area where the reeds were, the measurement was 2900nSv/h. This is a significant excess external dose, about 15 times, and in my opinion these areas should be fenced off from the public and remediated by having a sealing layer of neutral soil sufficiently deep to sustain vegetation cover which would prevent wind blown radionuclides contamination local properties and people. I have recommended in my report to you that this issue of contamination needs some independent scrutiny and urgent attention.

Sincerely

Chris Busby



The Tudor Shaft Informal Settlement which was established upon uraniferous tailings.

The latent impacts of heavy metals and TECNORMs such as Mg, Cu, Zn, Mn, As, Ni, Cr, Co and Pb on biota, including humans, of bioaccumulation and exposure to elevated levels of metals and TECNORMs are established in the international scientific literature.

Even though a large number of the rivers within the Witwatersrand goldfields are contaminated by heavy metals released from present day and historic mining operations, relatively little is known about the effects on communities that live beside and rely on these rivers for food and livelihood. One of the complications is that the toxicity of many metals is a function of such conditions as redox, pH and water hardness.

Some metals, when consumed in excess, can affect organs and the central nervous system, cause reproductive failure or birth defects, and act as cofactors in many other diseases. Certain receptors may be more sensitive than others, depending upon species, age, sex, season, body mass, metabolic rate, general health, diet, behaviour, etc, with younger animals and children being generally more at risk than adults under the same conditions of exposure.

There is the potential for trans-generational (genetic) impacts of bioaccumulated metals and TECNORMs on biota exposed above certain thresh-holds. The probability is that such latent impacts will only be identified and assessed over the next 100 to 500 years.

There has been significant reticence on the part of organs of state and mining companies to conduct epidemiological studies in order to quantify the health risks.

The future land use of reclaimed footprints of tailings dams and other contaminated sites for agriculture or grazing is inappropriate since it may imply edible crop production or pasture and rangelands populated by livestock. Apart from the high risks to mining companies or Government in the case of ownerless and abandoned mines of enabling edible crops and grazing systems on contaminated or degraded sites, grazing as a land use for re-mined footprints is considered sub-economic on rehabilitated mine pastures in South Africa. (Reference: *Mine Closure 2007 – South African Legislation Pertinent to Gold Mine Closure and Residual Risk*. M.W. Sutton et al. ISBN 978-0-9804185-0-7).

If the reclamation of tailings dams is to have regional ecological, social and environmental benefits, cognizance must be taken that:

- The deposition of tailings of reclaimed tailings dams upon unlined land will continue to generate Acid Mine Drainage if sulphates are not removed. It is generally and incorrectly assumed that the impact will decrease to acceptable levels after mine closure. The assessment of long-term risks can at best be described as subjectively qualitative in nature and no proper quantitative assessments were reported in any of the EMPRs
- That waste rock dumps have very large inventories of fine material and they are much more permeable to oxygen than tailings dams. The secondary source of contaminants that remain in the soil after a dump has been removed appears to be universally ignored and it is assumed that removal of the dump removes all potential for pollution from that site.
- The status of the geohydrological regime, the extent of contamination, preferential pathways and predictions regarding long – term migration have to be identified and mitigation and management options established for the containment and rehabilitation of contaminated groundwater.
- The potential impact on the groundwater from other surface contaminant sources such as the metallurgical plants, domestic and industrial waste sites are to be addressed.

## FINDINGS AND RECOMMENDATIONS THAT HAVE RELEVANCE

An airborne radiometric survey of the Far West Rand was done for DWAF (CGS). Interpretation of the data show many of the of the residential areas (Carletonville, Westonarea, Khutsong) fall within areas of high risk of radioactivity contamination. (Reference: Department of Minerals and Energy. 2008. *Regional Mine Closure Strategy for the Far West Rand goldfield*.)

Because of the huge uncertainties in the uptake of radionuclides in fish, studies on the fish consumption exposure pathway should be conducted. It needs to be established whether potential radiation dose from this route in the first instance is likely to be significant or not. (Reference: *Department of Minerals and Energy. 2008. Regional Mine Closure Strategy for the Far West Rand goldfield. 2008*).

The analysis of Uranium-pollution of water resources in the Wonderfonteinpruit catchment is mainly based on close to 3 400, mostly unpublished, values on U-concentrations of water samples gathered between 1997 and 2008. Results indicate that U-levels in water resources of the whole catchment increased markedly since 1997 even though U-loads emitted by some large gold mines in the Far West Rand were reduced. This apparent contradiction is explained by the contribution of highly polluted water decanting from the flooded mine void in the West Rand.

The U-levels of the whole Wonderfonteinpruit catchment result in some 800 kg of U per year flowing into the Boskop Dam as Potchefstroom's main water reservoir. Of particular concern is the fact that U-levels in the Wonderfonteinpruit are comparable to those detected in the Northern Cape which had been geostatistically linked to abnormal haematological values related to increased incidences of leukaemia observed in residents of the area. (Reference: *Uranium Pollution of Water Resources in Mined-Out and Active Goldfields of South Africa – A Case Study in the Wonderfonteinpruit Catchment on Extent and Sources of U-Contamination and Associated Health Risks. F. Winde. 2009*)

The use of contaminated material and mine residues in construction has also been identified as a means of dispersal of radioactive material into the environment. Contaminated areas have been identified and the need for comprehensive monitoring and study as well as epidemiological studies in affected communities are recommended. (Reference: *Department of Mineral Resources. Regional Closure Strategy for the West Rand Goldfield . 2009.*)

Airborne gamma ray survey data have been collected covering the Central Rand Goldfield. These data identify areas of elevated radioactivity. There has also been a historical migration of generally elevated radioactive levels to the urban areas of the Johannesburg central business district (CBD) indicating the use of mine dump and waste materials, for building purposes, as well as downstream plumes in wetland areas.

As a result of concerns regarding the potential radiological health hazards associated with the use of contaminated water, the National Nuclear Regulator found it necessary to recently conduct an independent assessment of the radiological impacts of the mine water discharges on the local population in the Far West Rand's Wonderfonteinpruit catchment. The report titled "*Assessment of the Radiological Impact of the Mine Water Discharges to Members of the Public Living around Wonderfonteinpruit Catchment Area*" – National Nuclear Regulator, 2007 – was produced where a number of pathways that could lead to significant radiological risks to the

general public were identified. It is likely that these conditions will be mirrored in other catchments of the Witwatersrand region impacted by gold mining operations. A similar assessment should be conducted for the Central rand Goldfield.

Pollution related to Witwatersrand mines poses a number of hazards to surrounding communities. The major primary pathways by which contamination can enter the environment from a mine site are the airborne pathway, where radon gas and windblown dust disperse outwards from mine sites, the waterborne pathway, either via ground or surface water or due to direct access, where people are contaminated, or externally irradiated after unauthorized entry to a mine site, by living in settlements directly adjacent to mines or in some cases, living in settlements on the contaminated footprints of abandoned mines. (Reference: *Land-Use after Mine Closure – Risk Assessment of Gold and Uranium Mine Residue Deposits on the Eastern Witwatersrand*, South Africa. M. W. Sutton. Mine Closure. 2008)

The two major airborne risks will be due to airborne radon and windblown dust. There is currently little publicly available data on either of these contamination pathways for the Witwatersrand Gold Mines. However, it could be expected that the most hazardous areas will be those in close proximity to mine residue deposits or other large concentrations of radioactive material. In any pollution scenario, it is important to understand the risk posed by the pollution to the local human population, as well as to the natural environment. Unfortunately, little information is available regarding the risk to non-human species due to radionuclides, particularly at low levels. (Reference: *Radiometric Surveying in the Vicinity of Witwatersrand Gold Mines*. H. Coetzee. Mine Closure 2008.)

Direct access to mine sites may also expose the public to risk due to direct external gamma radiation, inhalation and ingestion of radionuclides and chemotoxic metals, as well as the physical dangers inherent to mining sites. To limit the risk due to external gamma radiation, the Chamber of Mines uses a guideline that each tailings deposit should have a 500 m buffer zone surrounding it, where no human settlement is allowed. In many cases, however, this guideline has not always been adhered to in the development of new settlements. (Reference: *Radiometric Surveying in the Vicinity of Witwatersrand Gold Mines*. H. Coetzee. Mine Closure 2008.)

With the curtailing of gold mining on the Witwatersrand mining land is being redeveloped. However, inappropriate developments, such as houses or farms, on Mine Residue Deposit (MRD) footprints and other contaminated sites could result in liabilities for the public and the closing mines. Avoiding built developments altogether and vegetating MRDs and footprints with unsuitable plants species, such as those for pastures and playing fields, can also increase risk through the creation of ‘attractive nuisances.’ These encourage use by potentially vulnerable receptors such as grazing livestock and children. (Reference: *Land-Use after Mine*

*Closure – Risk Assessment of Gold and Uranium Mine Residue Deposits on the Eastern Witwatersrand, South Africa.* M. W. Sutton. Mine Closure. 2008)

It is assumed that all gold and uranium mine residues in the EMM (East Rand goldfields) contain higher concentrations of pyrite, metals and NORMs (Naturally Occurring Radioactive Material) than the surrounding lands, and no MRDs (Mineral Residue Deposits) are lined. The receptors are inter alia informal and formal settlements. Small children may ingest soil when playing; children and the poor are most at risk and least able to cope with pollution threats; the 1-2% of the population in EMM that rely on springs and rivers for domestic water stay in informal settlements; food plants are grown in home gardens of the poor and in nearby sediments; and there is uptake of contaminants by some vegetable species in these home gardens. (Reference: *Land-Use after Mine Closure – Risk Assessment of Gold and Uranium Mine Residue Deposits on the Eastern Witwatersrand, South Africa.* M. W. Sutton. Mine Closure. 2008)

There are approximately six thousand abandoned mines in the country. The abandoned gold mines from the Free State to Evander pose high environmental risk due to uranium. (Reference: *South Africa's Strategy for the Management of Derelict and Ownerless Mines.* H. Coetzee et al. Mine Closure 2008.)

As a consequence of the uraniferous nature of the ore, Witwatersrand tailings and other mining residues often contain significantly elevated concentrations of uranium and its daughter radionuclides, with the decay series of  $^{238}\text{U}$  being dominant. In recent years, concern has been expressed about the potential for these radionuclides to contaminate the natural environment, with a particular focus on the contamination of water resources (Reference: Institute for Water Quality Studies, 1995; Institute for Water Quality Studies, 1999, Department of Water Affairs and Forestry, 2003. *Radiometric Surveying in the Vicinity of Witwatersrand Gold Mines.* H. Coetzee. Mine Closure. 2008)

There is a lack of high confidence independent assessment of radioactive contamination of gold tailings. The lack of high confidence assessments should, however, not at any stage prohibit intervention from being applied, predominantly by the regulators. The criteria for intervention should be predetermined so as to ensure that the safety of members of the public is not compromised by protracted interpretations of safety levels. (*Establishing a Framework for Intervention and Remediation of Radioactive Contamination from Gold Mining – Learning from the Past.* J.F. Ellis. Mine Closure 2008.)

Previous radiological assessments were conducted based on current operations of mines and did not take into account historical off mine impacts of decades of mining. Assessments must be expanded to areas outside the scope of current operations to consider the legacy of off-mine contamination and bioaccumulation, which in itself has created secondary sources of pollution.

Detailed land use surveys must be conducted to more realistically evaluate the consumption and residence factors for all exposure pathways.

The assessments of effective doses of radioactivity to the public in the Wonderfonteinspruit Catchment Area did not comprise the so-called ‘air-pathways’ by which significant radiation exposure can occur in the surroundings of mining legacies, due to:

- a. Inhalation of Rn-222 daughter nuclides from radon emissions of desiccated water storage dams (e.g. Tudor dam) and slimes dams.
- b. The inhalation of contaminated dust generated by wind erosion from these objects, and
- c. The contamination of agricultural crop (pasture, vegetables) by the deposition of radioactive dust particles, which can cause considerable dose contributions via ingestion. (Reference: NNR Report, TR-RRD-07-006, entitled “*Radiological Impacts of the Mining Activities to the Public in the Wonderfonteinspruit Catchment Area*”.)

It was found, in terms of the NNR Report, TR-RRD-07-006, entitled “*Radiological Impacts of the Mining Activities to the Public in the Wonderfonteinspruit Catchment Area*” that “*during the sampling strong dust emissions from slimes dams during wind events were observed. Due to the small particle size of the slimes, particulate matter can be transported over relatively long distances to agriculturally used land in his surroundings. It has to be mentioned that the deposition of radioactively contaminated dust on leaves of vegetable and forage plants can cause radiation exposures exceeding those from the “inhalation of contaminated dust” substantially, being in the order of dose contribution of the so-called ‘water pathways’*”.

Soil exposed after reclamation of mine residue deposits has elevated concentrations of heavy metals in the topsoil, notably, Co, Ni and Zn. Although most of these metals were not currently mobile forms it was predicted that they would be leached into the ground water in the long run).

Some species of phreatophytes (i.e. plants that acquire most of their water from groundwater) growing over a shallow contaminated aquifer system abstract large amounts of inorganics from the plume. In the case of some tree species, naturally occurring radioactive materials (NORMs), rare earth elements and class B transition (‘heavy’) metals are accumulated and the deposition of litter results in significant topsoil enrichment.

Tutu et al (2005) showed that the uranium mobilized from exposed mineral deposit residues footprints is either in bio-available forms or where it is in secondary mineral phases it is potentially available. Winde et al. (2004), found salt crusts containing very high concentrations (>1 000 mg/kg) uranium.

Plant 'accumulators' can tolerate the uptake of metals to higher concentrations than present in the soil solution, and present a potential health risk because an elevated concentration in soil may be transmitted, through plant uptake, into the food chain. Plants are far more tolerant than animals of exposure to salts and metals, but highly elevated concentrations will result in detrimental effects, including reduced growth, vigour and regeneration (seed production, viability and germination). Impaired growth and regeneration has been demonstrated for numerous species on the TSFs, tailings spillages, polluted soils and groundwater, with herbaceous species being more compromised than resprouting perennials and woody species.

Elevated tissue metal concentrations were detected in the organs of wildfowl on the East Rand . McIntyre et al (2008a), have shown metal accumulation by some invertebrate groups on gold mine properties: Carabid beetles (scavengers) and Arachnids (scorpions and spiders). Causality has been demonstrated under laboratory conditions in a dose-dependent fashion by Haywood et al. (2004) for frog larval mortality in response to ARD and metal bioavailability. (*Environmental Impact Assessment Report. AngloGold Ashanti. West Wits Operations. 2009.*)

## CASE STUDIES AND NEGATIVE PRECEDENTS THAT WERE ESTABLISHED

### **Mintails**

It was found in terms of the National Nuclear Regulator's and Department of Water Affairs' *Wonderfonteinspruit Remediation Project: Site Identification Report*, May, 2010, that, as a result of Mintails' current reclamation of historical tailings dams: (The findings are copied verbatim and pasted.)

### Lancaster Dam

The area behind the Lancaster Dam appeared to have filled with slimes that have recently been mined. The Dam had been breached by heavy equipment so as to allow acidic slimes water and fine slimes to drain into the pond and wetland immediately below the dam. On this downstream side of the dam, there is an orange pool of settled slimes, filled with acid mine drainage water, where there are few plants and signs of dead wildlife. Dry slimes were observed blowing throughout the Lancaster dam site. Drainage of water from this area was ongoing at the time of the site visit.

**As the site presently exists it is suspected that acutely toxic acidic drainage** is currently draining from the site through the breach in the dam into the pond and wetland immediately below the dam. Because of the lack of any flow restriction this could become an extremely serious situation following a heavy rainfall. The main pollutants are suspected of being acidic water and associated toxic metals arising from oxidation of sulphides such as iron sulphide, also known as pyrite. The stream presently passes through the breach in the Lancaster Dam, with

visible seepage of slimes from the Lancaster Dam into the stream which forms the upper Wonderfonteinspruit.

### Tudor Dam South Side

The Tudor dam is located in the south eastern portion of the headwaters of the WCA. The dam was built before the establishment of Rand Water for water supply to the mine(s) in the area. The area behind the dam is currently dry and being mined by a company called Mintails to recover gold from the sediments that have accumulated as a result of past mining practices considered inefficient by today's standards.

At the time of the field visit it appeared that the re-mining had ceased. During the inspection there was no inflow or outflow of water and the dam was dry. There is however evidence that during rainy periods that water would flow into and out of the dam. The soils and sediments at the site are potentially contaminated with radionuclides. There is evidence of sulphate "evaporates" on the surface of the sediments. The activity concentration of uranium 238 in the soils and sediments behind the dam are high, 8000- 10000 Bq/kg with radium 226 at 1700-2800 Bq/kg.

Remediation of this site, from a radiological health perspective is required, in order to meet ALARA levels. (ALARA is the concept to be followed in radiation protection that states that all practices are to be carried out in a manner in which radiation exposure/doses are kept As Low As Reasonably Achievable below the dose limits, social and economic factors taken into account.)

**The Mine is currently in violation of its Water Use License** at the Lancaster Dam site and the immediate remediation of the Tudor dam site may be considered as a part of an overall "package". If the Mine does not agree to do this within this time frame the regulator could require that all licensed areas be fenced and made off limits to the public until such time as the site is rehabilitated.

**(Interpolation: The Tudor Dam is unrehabilitated, at the time of this submission, and there are no fences or warning signs. There is constant pedestrian traffic across the Dam and collection of scrap metal, soil, wood and reeds takes place. There are 17 persons living in an abandoned shop on the banks of the Tudor Dam. The Tudor Dam is in close proximity of the Tudor Dam Informal Settlement, Soul City, Baghdad, Bull Brand Informal Settlements and Kagiso.)**

As a condition of its license to mine the old dam sediments the Mine must be required to mine and remediate as mining takes place. The site can in this way be converted from a mining site to a rehabilitated site. Once mining is completed, the site should be graded removing any hazards and re-vegetated. Access roads should be removed following remediation to prevent illegal dumping in the rehabilitated areas.

### Stream Bottom 150m Downstream of Tudor Dam

This site is a dry “wetland” below Tudor Dam. The channel contained well-sorted fine sediments, most likely, slimes deposited from the overflow from Tudor Dam.

Uranium and radium activity concentrations were high here, at 2000 Bq/kg for uranium and 1200 Bq/kg for radium, as would be expected if they originated from the Tudor Dam. This site has contamination of radioactive material exceeding exclusion levels of 0.5 Bq/g per nuclide and will need to be remediated prior to the site being released from regulatory control.

The site presents medium-high uranium and/or radium levels, exceeding national or international clearance standards.

Remediation will be inexpensive and easy and should be done soon. Unlike the Tudor Dam area this area is not within the Mine’s authorised mining area or responsibility.

However, most of the sediments will be disturbed as a result of the **poor mining practices** at Tudor Dam and above. **During mining the Mine was responsible to contain this material and should be required to clean up the material.**

It will also be a lot less expensive for the Mine to clean it to release levels and receive mine closure rather than fencing it to keep people out and maintaining the fencing. It is recommended that this area be cleaned to release levels immediately following the rehabilitation of Tudor Dam site within the next 3 years or an ALARA justification provided as to why this should not be carried out.

Any erosion of material from this area will wash down into the Lancaster dam area and will have to be dealt with the mine at this location. Once this area has been cleaned up to release levels no significant amounts of materials would be available to wash downstream into the Lancaster Dam. It would be advisable to implement remediation action at Tudor Dam before remediation of Lancaster Dam to avoid recontamination of downstream areas.

**However, there are a number of environmental legislative requirements that the Mine would have to comply to before any operations may be allowed to continue.** This site must be cleaned up as part of the current Tudor dam cleanup operation. The Regulators must ensure that this requirement is incorporated in the current clean-up plan of the Tudor Dam.

### **Mine Waste Solutions**

The reclamation of 15 historic tailings storage facilities by the mining company, Mine Waste Solutions and the establishment of an **unlined** centralized tailings storage facility (CTSF) (super dump) within **one kilometer of the Vaal River** was authorized by the North West Department of Agriculture, Conservation, Environment and Rural Development (NWDACERD) on the 25<sup>th</sup>

of February, 2010. A water use licence was issued on the 11<sup>th</sup> of June, 2010 by Ms. Deborah Mochothli on behalf of the Department of Water Affairs. The authorization of the CTSF by NWDACERD was fraught with administrative blunders.

Mr. Piet van Deventer of Frazer Alexander acted as consultant for Mine Waste Solutions in the Environmental Impact Assessment process of the above-mentioned project.

In terms of the Environmental Impact Assessment Report the following gaps were identified:

#### Sulphuric acid plant

The EIA and Environmental Management Programme Report (EMPR) as well as all specialist studies were based upon the assumption that a sulphuric acid plant will be constructed, and that it would form part of the Mine Waste Solutions beneficiation process.

**It was determined that Mine Waste Solutions is no longer of the intention to erect the sulphuric acid plant. Failure to remove the sulphates from the tailings will result in significant generation of Acid Mine Drainage. The significant adverse impact of the tailings deposition on surface and groundwater, in the absence of the erection of a sulphuric acid plant, has not been assessed. This is a fatal flaw.**

#### Geotechnical and Geohydrological Investigations

Detailed unsaturated seepage modeling was not done for the centralized tailings storage facility. The reclamation sites (existing tailings storage facilities) are mostly located on dolomite / chert formations. Groundwater characteristic for these sites are unknown and NO site specific aquifer data exist. Detailed hydrogeological site assessments for each reclamation site were not conducted, notwithstanding the recommendations of the Environmental Assessment Practitioner.

Mine Waste Solutions is responsible for contamination plumes but existing contamination plumes were not clearly identified and delineated. In the current status future positive impacts of the proposed reclamation activities cannot be demonstrated.

Notwithstanding the aforesaid significant gaps, a water use licence was authorized.

There was no detailed geochemical assessment. There were information gaps in terms of geophysical survey data and groundwater exploration drilling.

The EIA for Mine Waste Solutions was conducted during the winter months. Assessment of hydrology requires a full hydrological cycle to encompass the impacts, and assessment of ecosystem goods and services could be similarly compromised by an accelerated EIA.

#### Wetland, Flora and Fauna Assessment

The environmental impact assessment for the Mine Waste Solutions' project was conducted during the winter months. The influence of seasonality on detection of flora and fauna, and evaluation of diversity is recognized worldwide. For example, within the Grassland Biome, most plant species (83% of which are actually non-grasses,Reyers and Tosh, 2003) and smaller fauna experience seasonal dormancy, whereas some avian species are migratory. At worst, if not conducted in appropriate seasons and for biologically relevant time periods, the environmental impact assessment could under-represent the biodiversity by almost 95%.

## **DRD GOLD**

The reclamation of tailings dams within the Carletonville Area by DRD Gold has resulted in habitual spillages of toxic and radioactive slurry off mine property. Please see subjoined photograph.



These spillages are often not reported to the Department of Water Affairs. In substantiation I refer to the subjoined response by Mr. Bashan Govender of the Department of Water Affairs regarding this particular spillage:

**From:** Govender Bashan (GAU) [mailto:GovenderB@dwa.gov.za]  
**Sent:** Thursday, February 10, 2011 12:07 PM  
**To:** Mariette Liefferink; mariette@pea.org.za

**Subject:** FW: BLYVOOR: SLUDGE SPILLAGE

**Importance:** High

Dear Mariette

Further to email below, please note an inspection was carried out on 08 February 2011.

Clean-up has commenced however the residue alongside the road is yet to be removed. The mine official advised DWA that they are waiting for the spill to partly dry out to facilitate removal. No impact on the water resources could be identified (except run-off due to storm water).

The Department has nevertheless informed DRD Gold that the spill was not reported to the DWA and has requested an incident report including management of the incident and close-out.

Regards

Bashan

## **ERGO**

ERGO (operated under AngloGold Ashanti) re-mined the slimes dams in the East Rand for 28 years before shutting down. The operations have now been sold to DRD Gold South Africa. ERGO, by far the biggest dump reclamation operation in South Africa, removed 870 Mt dry material, produced 250.7 t gold and made a total profit of R2 236 million (Ergo, 2005). ERGO made a positive contribution towards the area in terms of consolidating the tailings from several dumps into two mega dumps (Daggafontein and Withok). **However, these dumps are impacting significantly on the Blesbokspruit river system** (AngloGold Ashanti, 2008).

SUBMITTED BY:

Mariette Liefferink.

CEO: FEDERATION FOR A SUSTAINABLE ENVIRONMENT.

12 February, 2011.