EXECUTIVE SUMMARY

Ambient Air Quality is a function of the Dispose-Tech (Pty) Ltd, Shongweni Waste Disposal Site Air Quality Monitoring Plan, embodied within the Air Quality Management Plan. The Ambient Air Quality Test Results and Cancer and Non-Cancer Risk Assessment are issued on a six monthly basis. The results will be presented at the Shongweni Monitoring Committee Meeting on the 7 April 2005. This report presents results obtained from July 2004 to January 2005.

The Shongweni Waste Disposal Site, is a Class H:h waste disposal site (co-disposal landfills). It is equipped with a multibarrier liner system that included a leak-detection layer. The construction included graded stones (leak-detection layer), a 150 mm layer of compacted clay, a 1.5 mm PP liner and 150 mm clay layer, and a drainage and protection layer. The leachate containment and collection discharged biologically treated leachate to a municipal sewerage treatment plant. Landfill Gas is not collected or treated.

The "Source-Pathway-Receptor" concept is used in Air Quality Risk Assessment. An understanding of the source of the hazard, the characteristics of the receptor that may be at risk from the hazard, and the means, or pathway by which the receptor may be affected by the hazard is determined. Therefore within the risk assessment the following answers are sought:

- What are the hazards?
- What are the properties of the hazards?
- How may the receptor become exposed to the hazards?
- What is the probability of exposure?
- What is the scale of the exposure?
- How significant is the risk?
- What are the uncertainties?

The test results are attached in Tables 1 to 4.

Six Air Sampling Stations were established, three on the site and three off the site (Map 2):

Station A – ON-SITE, Boundary Adjacent to Paul's office, Northern Boundary of Waste Disposal Site.

Station B – ON-SITE, Boundary Adjacent to Leachate Dam, Eastern Boundary of Waste Disposal Site relocated in the last two sampling periods to the North Eastern Boundary of the Waste Disposal Site.

Station C – ON-SITE, Located next to Weather Station in the waste disposal site valley towards the Western Boundary.

Station D – OFF-SITE, Located on the premises of the Mushroom Farm.

Station E – OFF-SITE, Located approximately 600 meters from the Eastern Boundary of the Waste Disposal Site.

Station F – OFF-SITE, Located approximately 700 meters from the Western Boundary of the Waste Disposal Site.

PLEASE NOTE: SAMPLING STATIONS E AND F (OFF-SITE STATIONS) WERE VANDALIZED DURING THE FIRST THREE SAMPLING PERIODS. IT DID NOT SEEM TO MATTER WERE THEY WERE LOCATED THE SAMPLING PROBES AND STATION WERE BROKEN OR TAKEN. THEREFORE THEY WERE NOT REPLACED IN THE DECEMBER 2004 / JANUARY 2005 SAMPLING PERIOD, SINCE THIS LOSS OF EQUIPMENT AND DATA IS OF NO BENEFIT TO THE PROJECT.

The test results in Tables 1 to 4 are represented in the column headed EC (Exposure Concentration) and are expressed in micrograms per cubic meter (µg/m^3) of air. The environmental benchmark or exposure limit of choice was derived from the ENVIRONMENT AGENCY (2003a*) IPPC H1 Horizontal Guidance: Environmental Assessment and Appraisal of BAT.* Environment Agency Bristol. The long-term environmental benchmarked called Environmental Assessment Levels (EAL's) have been used in this case. Environmental benchmarks for both long-term and short-term effects in the receiving environment are available. Long-term effects may relate to those substances that are released continuously, frequently or over relatively long time periods. Short-term effects may relate to peak concentrations, intermittent or periodic emissions that occur over short time periods. The Odour Thresholds, in the last column, are derived from the ILO / NIOSH list of Odour Threshold Values (OTLV), *COMPILER'S GUIDE FOR THE PREPARATION INTERNATIONAL CHEMICAL SAFETY CARDS Odour Safety Factor (O.S.F.)* The non-cancer risk has been calculated and is tabulated in a summary table in Table 5.

The cancer-risk has been calculated and is tabulated in Tables 6 to 9. An estimated increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is a plausible upper bound estimate of the probability that a person may develop cancer sometime in his or her lifetime following exposure to that contaminant. There is insufficient knowledge of cancer mechanisms to decide if there exists a level of exposure to a cancer-causing agent below which there is no risk of getting cancer, namely, a threshold level. Therefore, every exposure, no matter how low, to a cancer-causing compound is assumed to be associated with some increased risk. The highest or "worst-case" Unit Risk Factor (URF) or Inhalation Unit Factor (IUF) was chosen from those listed by California EPA, WHO or USEPA IRIS and the excess lifetime cancer risk was calculated. To ensure that additive risk would be taken into account the excess lifetime cancer risk calculated for each carcinogen (cancer-forming substance) were summed. The cancer risk has been calculated and summarized in Table 10.

The Shongweni Waste Disposal Site's Priority Substance Inventory (PSI) was compiled from subsurface and surface sampling of trace components conducted since 1998. The Shongweni PSI is tabulated below in Table T-5:

Table T-5: Shongweni Waste Disposal Site Priority Substance Inventory

Priority Trace Component	CAS No.	Potential Impact	Category
Benzene	71-43-2	Health	Aromatic Hydrocarbon
Toluene	108-88-3	Health	Aromatic Hydrocarbon
Ethyl Benzene	100-41-4	Health	Aromatic Hydrocarbon
Xylene (all isomers)	108-38-3, 95-47-6, 106-42-3	Health & Odour	Aromatic Hydrocarbon
Trimethyl benzenes (all isomers)	526-73-8, 108-67-8, 95-63-6	Health & Odour	Aromatic Hydrocarbon
1,3-butadiene	106-99-0	Health	Aliphatic Hydrocarbon
Trichloroethene (trichloroethylene)	79-01-6	Health	Halogenated Hydrocarbon
Tetrachloroethylene	127-18-4	Health	Halogenated Hydrocarbon
Tetrachloromethane (carbon tetrachloride)	56-23-5	Health	Halogenated Hydrocarbon
Dichloromethane (methylene chloride)	75-09-2	Health	Halogenated Hydrocarbon
Ethanal (acetaldehyde)	75-07-0	Health	Aldehydes
Methanal (formaldehyde)	50-00-0	Health	Aldehydes
Hydrogen Sulphide	7783-06-4	Health & Odour	Organosulphur
Carbon disulphide	75-15-0	Health & Odour	Organosulphur
Methanethiol (methyl mercapatan)	74-93-1	Health & Odour	Organosulphur
Ethanethiol (ethyl mercaptan)	75-08-1	Health & Odour	Organosulphur
1-propanethiol (isopropyl mercaptan)	107-03-9	Health & Odour	Organosulphur
1-butanethiol (butyl mercaptan)	109-79-5	Health & Odour	Organosulphur
Dimethyl sulphide	75-18-3	Health & Odour	Organosulphur
Butyric Acid	107-92-6	Health & Odour	Volatile fatty acid
Valeric Acid	109-52-4	Health & Odour	Volatile fatty acid
Caproic Acid	142-62-1	Health & Odour	Volatile fatty acid
Propionic Acid	79-09-4	Health & Odour	Volatile fatty acid
Ethyl butyrate	105-54-4	Health & Odour	Oxygenated Hydrocarbon
Limonene	5989-27-5	Health & Odour	Terpene Hydrocarbon
p-cumene	99-87-6	Health & Odour	Terpene Hydrocarbon
a-pinene	80-56-8	Health & Odour	Terpene Hydrocarbon
Methyl Ethyl Ketones (MEK)	78-93-3	Health	Ketone
Methyl Isobutyl Ketones (MIBK)	108-10-1	Health	Ketone
1,5 diaminopentane	462-94-2	Health & Odour	Amine
1.4 butanediamine	333-93-7	Health & Odour	Amine
Ammonia	1336-21-6	Health	Inorganic compound

The only substance that was found to be above the Environmental Assessment Level (EAL) was formaldehyde. Formaldehyde was found to be in excess of the EAL during the month July 2004. However, it must be borne in mind that there were a number of bush fires and sugar fires during this period and this could account for the increase in the concentration of formaldehyde detected in ambient air.

The hazard quotients (HQ) were calculated by dividing each exposure concentration (EC) measured by the EAL. These HQ were then added together to calculate the Hazard Index (HI) which is used to assess additive non cancer risk. Table 5 depicts the summary of all four sampling stations from which exposure concentrations were measured. The results indicate that there was a minimal non cancer risk in the August/September 2004 sampling period and a low non cancer risk in the July 2004, October/November 2004 and December 2004/January 2005 sampling periods.

The excess lifetime cancer risk calculated, not only takes into account the highest of the agencies (Calfornia EPA, USEPA-IRIS and WHO) unit risk factors (URF), but also considers that a person would be exposed, at the sampling station location, for seventy years and for twenty four hours everyday. Therefore “worst-case” scenario has been considered in this study. In July 2004 there was a moderate to low excess lifetime cancer risk at all sampling stations. This was mainly due to the increase in concentrations of Formaldehyde at all four sampling stations. During the other three sampling periods there was a low excess lifetime cancer risk. However, it is interesting to note that carbon tetrachloride concentration detected at the Mushroom Farm in the August/September 2004, October/November 2004 and the December 2004/January 2005 sampling period created the highest risk at the Mushroom Farm, with lower risk at the on-site Shongweni Waste Disposal Site sampling stations.

It is recommended that in light of the promulgation of the Air Quality Management Act and the revision of the DWAF, Minimum Requirements for Waste Disposal by landfill, that the Air Quality Management Plan (AQMP), that includes the Air Quality Monitoring Plan be reviewed for the Shongweni Waste Disposal Site. This AQMP should only

include air pollutants that may cause risk to human health and the environment and odour, but must also include noise assessment on the boundaries of the site. The key elements of the framework are:

- Risk assessment
- Control measures
- Operational procedures
- Monitoring Plan
- Action Plan
- Closure and completion plan.

It is suggested that Lifetime Actual Daily Dose be considered on this site as the next step in the risk assessment, as this takes into account the actual dose to person and incorporates modifying factors, uncertainties and other pathways, e.g. ingestion.