

'ZWEJRA' LANDFILL

ALTERNATIVE FLY CONTROL

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Abstract

The Engineered Landfill in Disposal Area 1 (**Figure 1**) known as 'Taz-Zwejra' within the Maghatab Landfill has now been operational since May 2004 and has absorbed most of Malta's and Gozo's waste for the past months (**Plate 1 & 1.1**). No Fly Control Programme, in conformity with correct Landfill Pest Control Management, has so far been adopted at the site and a specific Fly Control Programme for the area is being sought to compliment the current Rodent Control Programme initiated in April 2004.

Project Objectives

The overall objective of this study was to investigate and propose an alternative Fly Control Programme involving the use of fly-attracting baits, other than those used in normal practice and which involve the application of insecticides across the entire waste surface areas using utility tractors equipped with specific spray booms.

Procedure

The Alternative Fly Control Study was implemented in the following stages:

First Stage:

- Identification of the fly species found at the site.
- Choosing a specific Bait Station.
- Choice of a Fly Bait Formulation

Second stage:

- On-site location and charting of each Bait Station
- Baiting of each Bait Station.
- Inspection and re-baiting of stations over a stipulated time-period

Implementation – First Stage

• Identification of Fly Species at the Site

One would generally categorise the majority of fly species inhabiting the site with, what may be termed as, '**Filth Flies**'. Such a category of flies would usually include, Blow Flies, Bottle Flies, House Flies, Flesh Flies and Soldier Flies. Several dead flies collected for identification purposes from various bait stations placed at the site did in fact reveal that the major species of flies inhabiting the site were indeed: **Blowflies, Greenbottle / Bluebottle flies, and House Flies.**

The filthy habits of each fly in this category make them easy vectors of diseases such as: Hookworm, whipworm, tapeworm, pinworm, roundworm, cholera, bacillary dysentery, infantile diarrhoea, typhoid and paratyphoid which are disease-causing organisms with which these flies are associated. **Filth flies** pick up with their mouth and other body parts pathogenic organisms from sewage, garbage, manure, decaying bodies and other such sources, which are then passed on to humans and animals through the faeces and vomitus of the fly.

The breeding areas of the fly species identified above usually include:

- Garbage
- Manure
- Rotting fruits and vegetables
- Decaying organic material
- Damp organic material
- Decaying grass
- Dead animals
- Faecal matter

House Fly & Blow Fly Biology

The common House Fly and Blow Fly Biology is enclosed in this report on **(Plate 2 & 2.1)**

• Choosing a specific Bait Station for the job

Considering the site's unique terrain and its exposure to weather conditions a specific Bait Station Marker had to be identified, which would need to be sturdy in construction, easily visible from a distance and conform to the hostile environmental conditions mentioned above. As a result, a specific Bait Station was devised 'in-house' **(Plate 3 & 3.1)** and which consisted of:

1. Thick plastic tubing of approx. 60cms in length x 2.25cm diameter, which would be hammered half way into the ground to act as an anchor for the station.

2. A strip of round wood of approx. 60cms in length x 2cm diameter that would need to be inserted into the hollow section of the ground anchor pipe.
3. A 30cm square water-resistant plywood of approx. 3mm thickness. This would in turn be screwed on tightly through the centre onto the round strip of wood mentioned above.
4. A round plastic bait container of approx. 32cm in diameter with a 5cm rim which would ultimately be fitted together to the above-mentioned plywood base and round strip of wood, using a common screw that runs through the centre of the plywood base and bait container, right into the core of the round wooden strip of wood, assembling and securing tightly all together.
5. A bait station cover, chosen of 1cm square wire mesh, was designed to render the fly bait within the stations unavailable to non-targeted species. (**Plate 4**)

- **Choice of a Fly Bait Formulation**

The choice of an ideal fly-bait formulation was essential in our study and indispensable towards its success. A specific 'Comtec' Fly Bait formula, which over the years was proven to be successful in many a different fly control situations, was chosen for this particular exercise. We were convinced that this formulation would in turn provide the best possible solution both in attracting and destroying flies. It was anticipated that the whole study would need to be sustained with as much as one hundred kilos of Fly Bait and an initial mix of twenty kilos of bait was mixed prior to the proposed 'on-site' installation exercise. The formulation, consisting mainly of a mixture of Bran, Sugar and active ingredients was mixed as follows: (**Plate 5 & 6**)

Bran.....	48.0%
Sugar.....	48.0%
Active ingredients....	4.0%

Implementation – Second Stage

- **On-site location and charting of each Bait Station**

A most recent plan of the 'Zwejra' Engineered Landfill site was forwarded to us by WasteServ Malta Limited. (**Fig. 2**) It was highly important that in view of the continuous shifting and re-shaping of ground, a recent / updated plan of the area be obtained. A site-plan is an important tool upon which the study was to be built.

It was estimated at the time, that the area of the landfill site totalled approximately sixty-two thousand square meters (62,000sq.mts.) with a perimeter length of half a kilometre. (500mts)

The on-site location and charting of all Fly Bait Stations was initiated on Saturday 21st August 2004 and concluded on the same day. (**Plate 7 & 7.1**) Such an exercise involved the installation of thirty-three (33) stations, which were equally distanced apart at approximately 15.25 meters (50ft.) along the entire landfill perimeter. Each station was numbered accordingly and its location specifically charted on the plan. (**Fig. 3**)

During the course of our on-site installation procedure, it was noted that the chosen design and structure of the Fly Bait Stations were indeed meeting on-site requirements, being all clearly visible (standing at approximately one meter above ground), sturdy and well secured to the ground, which is a necessity in windy and inclement weather conditions. (**Plate 8**)

- **Baiting of each Station**

Once all stations had been installed at their chosen location, the Baiting Procedure was taken on immediately on the same day, starting off at Fly Bait Station '1' and proceeded progressively to Station '33'. Four hundred grams (400gms) of Fly Bait was placed in the tray at each station, (**Plate 9**) which in turn were all covered with wire mesh as a precautionary measure, as already indicated earlier on in this report. (**Plate 9.1**)

- **Inspection and re-baiting of stations**

The study period was intended to cover a period of two weeks and include seven inspection / re-baiting visits, however in agreement with WasteServ Malta Limited, a further two extra visits were carried out, which indeed helped to substantiate our findings further, especially in confirming a constant fly escalation in the early Autumn, as indeed the study confirms.

The inspection / re-baiting visits at the landfill were carried out on the following order:

Monday 23 rd August 2004	...	...	...	...	Inspection on all stations
Wednesday 25 th August 2004.	...	...	...	...	Inspection & Bait change on all stations
Friday 27 th August 2004	...	...	...	...	Inspection on all stations
Monday 30 th August 2004	...	...	...	...	Inspection & Bait change on all stations
Wednesday 1 st September 2004	...	...	...	...	Inspection on all stations
Friday 3 rd September 2004	...	...	...	...	Inspection & Bait change on all stations
Sunday 5 th September 2004	...	...	...	...	Inspection on all stations

and

Thursday 16 th September 2004	...	...	...	...	Inspection & Bait change on all stations
Friday 1 st October 2004	...	...	...	...	Inspection on all stations

Inspections and Observations

A specific Report Sheet (**Fig. 4**) containing all station numbers was generated for each inspection date. The specific Report Sheets not only included the number of dead flies noted at each station but also relevant information and observations pertaining to the study, and included particular weather conditions, insect activity at the stations, identification of dead insect species, station movement (due to ground works), attraction of spent baits, etc. The information below is of a general nature and is indicative to each particular visit. Final graph charts compiled from the above mentioned Report Sheets are being included further down in this report.

- **Monday 23rd August 2004**

An inspection on all Fly Bait stations was carried out on this day. Weather conditions were normal. Very few flies were observed on the stations, with most of them having as many as one to two dead adult flies on the bait. However, a considerable number of young dead flies were observed in nearly all stations, (**Plate 10**) namely on station nos.: 6, 17, 21, 31, 32 and 33. It was observed that in general, fly activity at the site was indeed limited.

- **Wednesday 25th August 2004**

An inspection on all stations and a complete bait change was carried out during this particular visit. During our inspection dense patches of flies were noted on exposed waste in various areas of the landfill. An increase in the number of adult dead flies on the stations, compared to the previous visit was also observed, with stations having as much as twenty adult dead flies. (**Plate 11**) An increase in the number of young dead flies was also evident, especially in station nos.: 3, 4 and 14. Station nos. 20 and 21 were removed from their original location by landfill staff, but had been re-positioned as close as possible to their original position. Fly activity on the surface of the bait was noted on station nos. 25 through to 32. Weather conditions were good.

- **Friday 27th August 2004**

All bait stations were again inspected during this visit. A decrease on the total adult dead-fly count was noted and this could be attributed to strong windy conditions prevailing at the time. Even though the fly bait itself was not extensively disturbed by windy conditions through the formation of a thin crust at the surface when this is exposed to the elements, strong windy conditions would certainly effect the flying activity of flies and also lower the attracting effect of the bait.

Furthermore, the windy conditions tend to blow out of the bait station trays a number of dead flies, which when dehydrated, become very light and are blown off. In view of the foregoing, we believe that the slight decrease registered from the previous visit was only due to such conditions as mentioned. No dead-fly count could be registered from station nos. 12, 21 & 22, which were removed by landfill personnel for ground shifting purposes.

- **Monday 30th August 2004**

An inspection and complete bait change on all stations was carried out on the above date. A considerable rise in the adult dead-fly count was registered, (**Plate 12 & 12.1**) not only because no windy conditions were noted which might have interfered in the rising trend of dead flies as explained above, but also the weather was hot and humid. High humidity levels accompanied by elevated temperatures are ideal conditions for insects to breed and multiply quickly and this fact was indeed reflected in the increased amount of dead insects on all stations. The overall count of dead insects was over nine times as much as was registered in the previous visit. Station nos. 2, 3 & 4 were re-located due to road works. On the day it was observed that it only took a limited period of three and a half minutes for a fly to be fully effected by the insecticide contained in the bait, once it landed and freely fed at the station.

- **Wednesday 1st September 2004**

An inspection was carried out on all stations. A strong wind was at the time prevailing at the site and a decrease in the total count of adult dead flies was noted on all stations, which this time was approximated half of what was registered in the previous inspection visit. Our observations noted in previous visits were this time substantiated further and could allowed us to confirm that the attraction of flies to the bait stations and the actual dead-fly count, were indeed weather-related. Notwithstanding, the rising trend in numbers of dead flies was still being maintained and seemed to be progressively increasing. This time a count of young dead flies on all stations was also taken and these did indeed out number of dead adult flies six times over, which was encouraging.

- **Friday 3rd September 2004**

An inspection and complete bait change was carried out on the above-mentioned date. The rising trend of dead adult and young flies on each station was maintained yet again and as much as eighty dead flies were noted on one particular station, namely no. 32. Very calm weather conditions were noted on site with station no. 70 having the highest count of dead adult flies. (**Plate 13**)

- **Sunday 5th September 2004**

No bait change was effected on this particular date and a good breeze was noted at the landfill. Fly hot spots previously noted at the site were this time less busy. All stations visited registered an increase in fly activity on them with more or less the same count of adult and young dead flies as was recorded on the previous visit. It was noted that the spent fly bait purposely left on the ground close to the actual stations, was indeed still attracting flies with fly activity noted on and around it proving the high persistence of the chosen bait-formulation. As already highlighted before, this inspection visit should have been the last in our study, however as a result of a management meeting held at WasteServ offices on the 9th September 2004, it was decided to extend the study by a further two visits, which were effected as hereunder:

- **Thursday 16th September 2004**

An inspection and complete bait change was carried out on the above-mentioned date. Weather conditions were fine with the exception of a slight breeze blowing across the site. All bait stations were all very active with a considerable number of flies flying on and around the stations, (**Plate 14 & 14.1**) which further confirmed that the attracting powers of the bait do in fact go beyond eleven days, which is the number of days since our last inspection visit. The increase registered in adult and young dead flies on each station confirmed the consistent increase of fly populations noted as the study progressed, with one particular station containing as much as over two hundred and fifty dead adult flies. From previous observations, it was established that the ratio of young dead flies to adult dead flies on each station was established at approximately 2.6 young flies to 1 adult fly.

- **Friday 1st October 2004**

The last inspection on all stations in conclusion of our study was carried out at the above-mentioned date. The amount of dead flies found on each station did indeed, surpass any amount registered in previous inspection visits. (**Plate 15**) The accumulated dead insects over the previous fifteen-day period combined with the adult dead-fly count of the day, re-confirmed yet again, the increasing trend of dead insects on each station observed since the initiation of our study. Bait containers on particular stations were practically overflowing with the dead insects. Furthermore, it was noted that the bait was still attracting flies, even through covered by a thick layer of dead insects and even if in the interim period, this was also exposed to rain. The weather conditions on the day were calm and a dead-fly count could not be registered on bait station no. 6 due to its removal for earth works.

Results

The overall results obtained from the above inspection visits have been compiled and interpreted in three specific charts, namely the:

- Total count of recorded Fly Kill for each consecutive visit. (**Fig. 5**)
- Total Fly Count for each consecutive station. (**Fig. 6**)
- Intensity and location (**Fig. 7**)

Conclusions

The study initiated on the 21st August and concluded on the 1st October 2004, was a first of its kind carried out at the 'Zwejra' Engineered Landfill and as initially explained in the 'Project Objectives', the main aim of the study was to investigate and propose an alternative approach to fly control.

Having noted all our observations and studied such information throughout the course of our assessment period, we believe that a Fly Bait Control Method (even though not necessarily on its own), would surely help to considerably reduce the population of flies at the landfill site.

As figures and visuals included in this report show, the Fly Bait Method did in fact contribute to the eradication of a substantial amount of flies and when one considers that with each female fly killed, a further 400 / 750 flies have been avoided, then the beneficial aspects of such a method surely outweigh the current odds of not having any form of control whatsoever.

In support to the above theory and taking as an example one particular baiting period alone, (i.e. from the 16th September and 1st October) when the dead-fly count was estimated at around 4000, it could then be concluded that the elimination of offspring for that period was in the region of 1,500,000. This phenomenal number excludes offspring of flies that died after feeding on the bait and flying off the stations shortly after. We admit that, even though the study was meticulously carried out, it could not however be conclusive in this respect. However, in generally estimating that in five minutes at least ten flies would have landed on each station, briefly fed and flew off to die else, then one could conclude that the dead-fly count could have gone well beyond 47,000 resulting to an off-spring elimination of nearly 9,000,000 flies.

No record could also possibly be taken of all flies that have fell dead on the surface of the bait and then blew out of the station in strong windy conditions. We are sure therefore, that the effect was definitely much more than what **was actually recorded** on our Inspection Record Sheets.

Another important factor that may have effected the final results was the positioning of stations at the site. We consider stations erected at the closest proximity to fly-dense areas, an important factor, but due to continuous ground shifting activities it was not possible to have the stations directly erected on the landfill surface. However, by having the stations placed along the immediate perimeter area of the site created a barrier for flies approaching or leaving the landfill.

During the course of our study it has been also noted that weather conditions are also an important factor when using this method of treatment. Strong windy conditions interfere with the normal flying patterns of flies and the dead-fly count on the stations has been low when such weather conditions prevailed. To the contrary, it has been noted also, that the attraction and killing powers of the fly bait seemed to intensify after rainy conditions. High humidity is also an important factor especially in calm conditions and increases the dead-fly count at the stations.

Besides weather conditions, seasons also play an important role in fly control and dictate when fly treatments should be intensified or not. Guided by the fact that fly multiplication is temperature / humidity-related, the most likely seasons in which fly activity would increase at the landfill, is in Spring and Autumn. This theory was further sustained during our study when it was noted that the number of dead flies

on all stations progressively increased throughout September and shot up in the last two visits carried out on the 16th September and 1st October.

Ultimately, the level of fly infestations at the site is also dependant on other factors which are synonymous to the kind of waste actually being deposited and to whether or not the waste surface is being completely covered with earth to a depth of at least nine inches and compacted. It is also a fact that lots of flies are being imported to the site via the numerous amounts of waste trucks that continuously enter the site to unload. If the above factors are however well addressed and managed accordingly, we are confident that fly infestations could further be reduced.

Recommendations

As already stated above, we believe that the information obtained throughout the Fly Control Study, proved beyond any doubt, that the Fly Bait Method can indeed contribute to the eradication of large number of flies at the 'Zwejra' Landfill and when maintained through an on-going Fly Control Programme, will keep fly populations at the site under control. In view of the foregoing we are thus putting forward the following recommendations:

1. The Fly Bait Method around the perimeter area of the 'Zwejra' site and around the new sites currently being developed (**Plate 16 & 16.1**) be uninterruptedly sustained by weekly Inspection Visits throughout the months of September, October, November and April, May, June each year. It is also being recommended that during each Inspection Visit, the fly bait be also completely changed on each station respectively.
2. The above weekly Inspection Visits are to be, (when necessary), also complimented with 'spot' insecticide applications in isolated fly-dense areas on the waste surfaces, which for particular reasons, may be available to flies as an ideal breeding ground. The above-mentioned areas may be treated with the use of a motorised air-mist knapsack sprayer carried out by a specifically trained pest control technician.

However, may we reiterate that the above 'spot insecticide applications' are not being proposed as a sole remedy to fly control at the site, but as part of a comprehensive Fly Control Management Programme which, as we are proposing, embraces on-going Fly Bait applications.

Furthermore, may we also state that our recommendation for 'spot treatments' is being put forward on condition that preferably such treatments are excluded to areas that go above 3000 square meters at any one time. If and when the request for spot treatments should go above a total area of 3000 square meters, we recommend that the Fly Control Programme, as is being suggested, be re-evaluated and if necessary replaced with the conventional application of residual insecticides across the entire waste surface area of the site, using utility tractors equipped with the required spray booms for such a task.

Declaration

As mentioned in the beginning of the report, the request for such a study was commissioned by WasteServ Malta Limited to propose an alternative Fly Control Programme for the 'Zwejra' Landfill that goes beyond the normal practice of regular applications with residual insecticides across the entire waste surface area and do hereby confirm that to our knowledge, the above Alternative Fly Control Study was conducted in accordance to clients' requirements and delineates, in the first instance, the current fly situation at the site and moreover endorses a sound recommendation for a comprehensive Fly Control Programme.

Further information and clarifications about this presentation may be obtained from the author himself, Mr. Ronnie C. Galea CBiol, MIBiol, FRSH, RPPT (Adv.), FIHPE, MBPR (PHPC) or from collaborators, namely Mr. George Cruickshank – Technical Field Officer and Mr. Frans Vassallo – Pest Control Technician in-charge.