Landfills Inventory
Final Report

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1 Summary

The Tacis Programme “Improvement of the solid Household Waste Management in Donetsk Oblast” has defined and realized a qualified inventory of the landfills of the territory. It’s a beginning as there’s much more than 53 landfills and the job must be continued. The audit on the field has been done by the company Ukrentech in Donetsk.

The method specifically developed for this qualified inventory includes mainly an audit on the field with several light equipments and a standard report. This report is essentially a form with >100 parameters which are all observable on the field. For some criteria a quotation is made on two columns: one for the hazard assessment, the second for the interest for exploitation. This second criterion is justified by the fact that, if there’s a regional plan for the construction of 10 sanitary landfills able to cover the needs of the oblast, this plan will run along the next ten years, and it is necessary to determine the best existing landfills to use till the construction of the new ones.

2 Context

2.1 The question of the landfills in Donetsk Oblast

[1]The State Department of Ecology and Natural Resources of the Donetsk Oblast asked in 1999 a help from the European Union. In 2002 the European Union entrusted to the consortium Thales EC & GKW the programme EuropeAid/112554/C/SV/UA "Improvement of Solid Household Waste Management in Donetsk Oblast of Ukraine" whose beneficiaries are the Ministry of Environment of Ukraine and Donetsk Regional State Administration and whose main recipients are the State Department of Ecology and Natural Resources in Donetsk Oblast and Department of Housing and Public Utility Services of the Regional State Administration.

The general purpose of this project is to improve the sanitary and ecological state of the region, considered as highly polluted, mainly due to industrial activities. However, the household refuse, and the lack of care about SHW contributes already to a degradation of the ecological situation.

In accordance with the Questionnaire, the local authorities of cities and rayons of the Oblast manage 300 SHW dumps/landfills (including the dumps of village councils). Only 64 of them are used for disposal of SHW collected in a mechanised way by public utilities, 41 of these dumps are located in 28 cities of regional subordination. Many of them have already exhausted their capacities, other will be full in the short-term perspective as there are more than 30 dumps that have already been operated for 20 to 50 years.

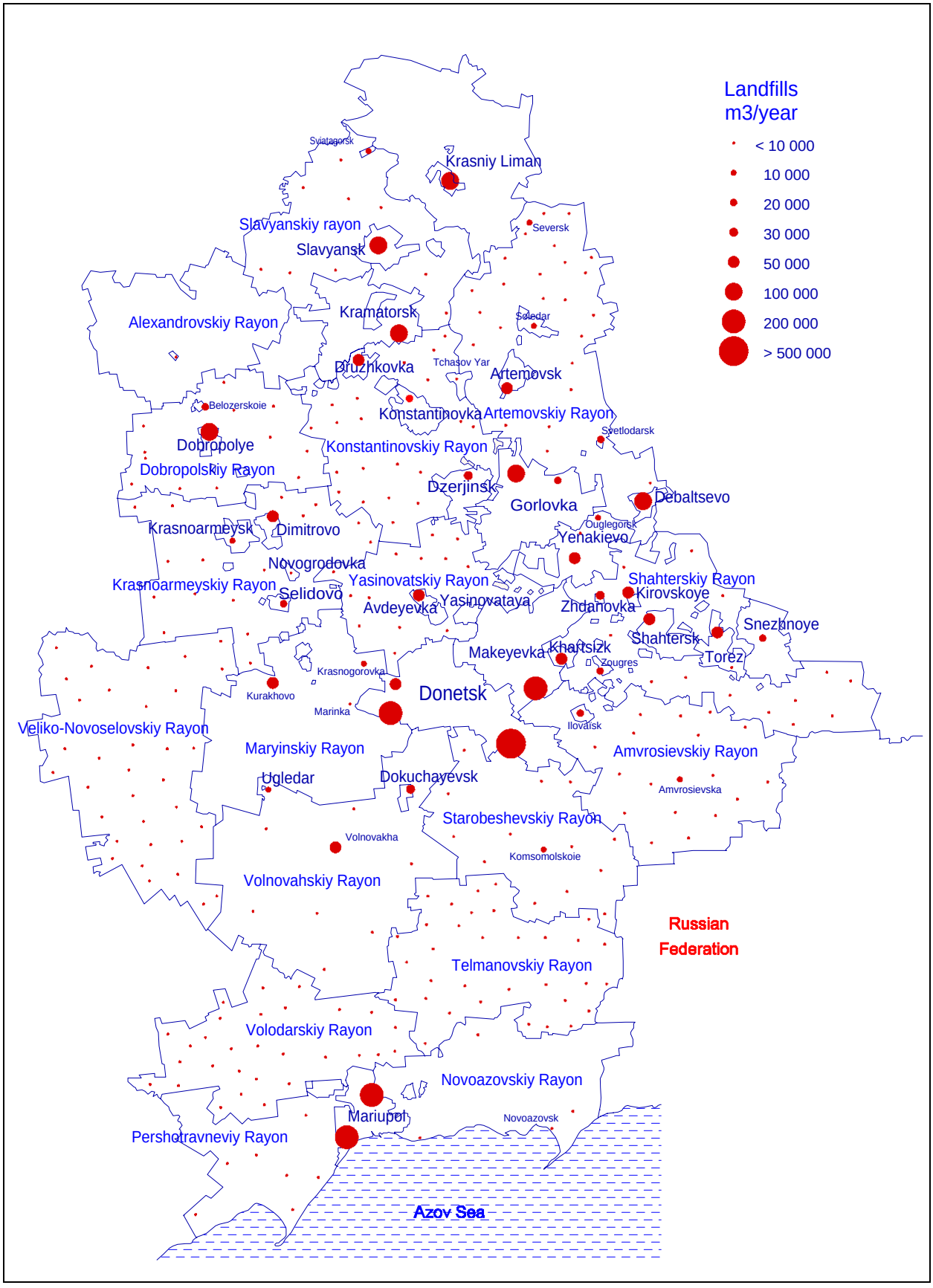
The passports for waste disposal sites allowing to include a dump into the regional inventory of waste disposal sites have been developed only for 29 dumps, i.e. 10%.

The answers that could be extracted from the Questionnaire sent to the administrative units are incomplete. Nevertheless they have the merit to exist and they are reproduced on the *Map 1 Landfills used by administrative units* on which the landfills are put on according to the yearly volume of disposed household waste.

The less that can be said is that there's an atomisation of the landfills. It's typically the situation of past practices. Each one is putting the waste in the closest hole. Unfortunately such an approach is still in use.

A Regional Programme of Sanitary Landfills has been decided for the construction within the next years of 10 regional sanitary landfills. A subsidiary question is the management of the transition period. So it's necessary to determine the most interesting existing landfills (the less harmful but also the most convenient) able to receive the waste, area by area, until the construction of the new ones.

[1] PLAN 040701 E9 §1.1, §1.2, §2.6.1, §2.6.3



Map 1 Landfills used by administrative units

2.2 Qualified inventory

[2]It may be supposed that it exists more than 1 000 landfills and dumpsites over the territory of the Oblast, known or forgotten, able to impact environment and human health. In aim to manage this problem with the today and short term available means, the strategy is to define a 3 levels risk assessment method, whose objectives are:

- Level 1: to determine within an half-day or a one day if a landfill is potentially dangerous
- Level 2: to determine the potential of danger of a landfill and the emergency degree for a "safetization"
- Level 3: to determine the measures to be taken

2.2.1 Landfill remediation

A main question in a lot of countries is to close properly a large number of landfills and dumpsites. It may request a lot of money and we have tried to propose a method of risk assessment whose the objective is to define priorities in a landfill closure program. Case by case, the closure of a landfill requires studies. Sometimes it will even be necessary to do a remediation of the landfill. So we present in this part the main principles for all these studies and works.

2.2.1.1 Definitions

Three notions must be clarified: closure, remediation, restitution.

Closure

Strictly speaking, the closure of a landfill is only the decision to stop to bring waste on it. Usually, it's only materialized by disposing obstacles on the access ways and it's let the nature to do its job. After some time, a vegetation begins to develop on the landfill and some years after, it's impossible to recognize a landfill if not by some waste appearing throughout the vegetation.

Remediation

The remediation consists in putting in a security state a closed landfill. Different steps can be defined. In aim to avoid waste dissemination, fires and accumulation of water in the landfill, it's convenient to cover the landfill with a layer of earth. In aim to avoid collapses and to make easier the discharge of the rain water, the slopes of the landfill may be worked before to dispose the earth layer. Biogas control and underground waters are subjects of particular studies.

Restitution

Often landfills and dumpsites have been created at the immediate neighbourhood of housing areas and the development of the cities and villages has progressively included these landfills in the housing areas. Tourism has also

[2] 030718Landfill Audit

brought some reflections about aesthetic of landscapes spoiled by landfills. The concept of restitution to the landscape appeared as the design of a final state of the landfill in aim to insert it aesthetically in the landscape.

2.2.1.2 International good practices

The general objective is to control the impact on environment and health for a period of at least 25 years, supposing that there's only household waste in the landfill. It is also supposed that there will not be any permanent keeper on the site and that, the more often, there will be only a periodic inspection, the periodicity may be one year or more!

In 2004 February, according to ADEME (Agency of Environment and Energy), France accounted more than 8000 landfills to be remedied in the next 10 years. ADEME classified the landfills among three categories: 40% are classified as "low impact" and ask only for summary re-arrangement works; 40% are classified as "medium impact" and must be submitted to complementary studies before to be re-classified; 20% are classified as "strong impact" and require specific works of remediation (embanking of the site, setting of draining walls in aim to divert underground waters, reinforcement of the landfill slopes, treatment of the biogas and the leachates, …) defined by a deep study of the site.[3]

2.2.2 Fitting to the Ukrainian situation

In 2004, Ukraine has no means for the landfills remediation. There's a lot of other priorities. Nevertheless, as low are the means, it can exist some high emergencies and it's important to detect them as soon as possible.

The clever management of the transition period supposes to know what are the most favourable sites for the disposal of the household waste which are produced every day. These sites will requires some short studies and eventually some works and they must allow to keep the situation under control with good practices for the operation of the landfills.

So it has been decided to begin a qualified inventory of the existing landfills aiming at a classification according two criteria:

- the degree of hazard for the environment and the public health;
- the interest to pursue the exploitation of the landfill during the transition period.

[3] Atoodéchet Newsletter 25-02-04

3 Methodology

3.1 Comments

The inventory of the landfills is a legal obligation according to the regulation of Ukraine (Resolution of the Cabinet of Ministers N° 1216 of 03/08/98). An other regulation (Resolution of the Cabinet of Ministers N° 1218 of 03/08/98) *On Development, Approval and Review of the Waste Generation and Waste Disposal Limits* is also commonly called passportization of the landfills.

This 1st level audit is a (very) short study of a landfill trying to go further than a simple inventory, so it shouldn't be in contradiction with the passportization of the landfills but is in fact a practical way to begin this legal inventory that was not already done.

[4]The Tacis Program had to develop a methodology to achieve this 1st level audit, using the equipments bought for this purpose (multigas analyzer, groundwater depth meter, GPS, software). This methodology will be transferred to the inspectors within the frame of the training program of Inspection enhancement.

The perfecting of this methodology can only be achieved by an "on field" application, requiring a few landfill audits by the experts of the Tacis Program.

3.2 On field operations

3.2.1 Available means for 1st level audit

It is not yet decided if this audit will be achieved by all inspectors or by a specialized team of the Inspection.

The available means in the frame of the Tacis Programme are:

- 1 field gas analyser de terrain measuring CH_4, CO_2, H_2S, O_2, fitted with a sampling probe for a depth 2 m maxi;
- 1 GPS metric with a cartography (low precision) of Ukraine;
- 1 metering equipment of level of watertable in piezometer (dipmeter) until 100 m;
- 1 detector of radioactivity;
- 1 digital photo camera.

3.2.2 Objectives of knowledge

3.2.2.1 Risks

Potential risks are:

- contamination of the surface waters by the leachates and incidentally uses of the surface waters;

[4] 030718Landfill Audit

- contamination of watertables by the leachates and incidentally uses of the relevant watertables;
- diffusion of gas breathed by the neighbour people;
- presence of radioactive waste;
- risk of explosion of the landfill;
- risk of collapse of the landfill.

3.2.2.2 Parameters

We want to know:

- the nature of the stored waste (household or industrial waste);
- the surface of the landfill;
- the volume of waste
- the cover of the landfill;
- the age of the waste;
- the potential of production of biogas;
- the receptacle of the leachates (surface waters or underground waters)
- the local geology and hydrogeology;
- the radioactivity of the waste;
- the stability of the mass of the waste;
- the closest target of neighbours.

3.2.2.3 Database

All the collected data must feed a geodatabase (GIS + database).

3.2.3 Method of audit

3.2.3.1 Preparation of the audit

The landfill to be audited must be grossly located on the regional map at 1/200,000. It must be named.

The existing documents (maps, reports, analyses) must be enquired at Department of Ecology, local Inspection, municipality or rayon.

The equipment must be checked. The batteries must be charged. Reserve dry cells must be present.

3.3 Standard report frame

3.3.1 Database of landfills

La première partie du rapport a pour objectif de constituer une base de données des décharges du territoire de l'Oblast de Donetsk. Pour cela, le rapport comporte un tableau à remplir. Pour le moment, c'est le tableau *Table 2* ci-dessous qui est proposé. Il pourra être amélioré ultérieurement en fonction de l'expérience acquise sur le terrain.

3.3.2 Pictures and scheme

Ce rapport sera complété par tous les éléments d'observation de l'inspecteur, les photos prises et les analyses des échantillons prélevés.

This report will be complemented with all the observations of the inspector, the pictures and the analysis of the samples if. Such an accumulation of pictures put a problem.

On the other hand it's necessary to use the data of the GPS for the calculation of the area of the landfill and the area of the existing waste.

So, the best way is to use the contour of the landfill as it has been drawn with the CAD software and to locate on it vignettes of each picture at the place it has been shot.

3.3.3 Comments

Il est particulièrement important que l'inspecteur décrive soigneusement ce qu'il a pu observer, en particulier les éléments qui représentent à ses yeux un danger. Rappelons que la notion de danger comporte plusieurs paramètres :

- le potentiel du danger identifié,
- l'ampleur du phénomène s'il se produit,
- la probabilité d'occurrence,
- la sensibilité du milieu exposé au danger.

Par exemple, le risque d'une explosion de biogaz (identification) : énergie dégagée par l'explosion (ampleur), probabilité d'une explosion, personnes pouvant être touchées directement par l'explosion.

3.4 Risk assessment and interest assessment

3.4.1 Method

La méthode proposée par l'Environmental Agency britannique[5] comporte une notation des critères inspectés. Cette notation va de 1 à 15 selon les paramètres résumés dans le tableau 0 suivant :

[5] Work Instruction – Licensed Waste Management Facility – Site Inspection Methodology and Consistent Scoring Guidance, version 3, 14/01/04

Table 1: Scoring of criteria inspected

Titre	Notations			
Notation des critères inspectés	Conformité et infractions techniques mineures	Pas d'impact ou problèmes mineurs	Incidence à long terme	Pollution immédiate
	0	1	2	3
Majoration	-	3	6	9
	-	-	Si la non conformité risque (en cas d'accident) d'être classée en catégorie 2, noter 10	Si la non conformité risque (en cas d'accident) d'être classée en catégorie 1, noter 15

Il va de soi que cette méthode vise surtout à noter la conformité de l'installation par rapport à une réglementation très élaborée et globalement respectée. Or nous sommes dans une situation où la réglementation n'est généralement pas respectée du tout. Noter toutes les infractions à la réglementation n'aurait pas grande signification : à quelques exceptions près, toutes les décharges auraient de très mauvais scores. Or nous voulons discriminer les installations en au moins trois classes de danger : très grave, grave et mineur. Nous avons un autre objectif : déterminer les installations qui peuvent être maintenues pour satisfaire les besoins de la période de transition, le temps de construire de nouvelles décharges sanitaires. On peut même imaginer qu'une décharge soit classée comme dangereuse mais aussi classée comme pouvant être maintenue en exploitation quelques années. Cela suppose simplement que des travaux de mise en sécurité, raisonnables en termes de coûts, soient faits.

Nous devons donc noter les observations selon deux grilles différentes.

Si nous ajoutons deux colonnes de notation comme sur le *Table 2: Scoring of the risk factors* suivant, nous pouvons affecter des notes à certaines rubriques. Nous proposons des notes pour certains facteurs de risque, ou des fourchettes de notes (comme 0-6 pour de 0 à 6) à l'appréciation de l'inspecteur, et parfois des notes négatives, en particulier pour évaluer l'intérêt de maintenir la décharge en exploitation.

Table 2: Scoring of the risk factors[6]

Dump (landfill) name			Unit	Haz	Expl
Official status	❑	Passportized		0	-5
	❑	Registered		3	
	❑	Unknown		9	15
Availability date of permits for the use of land for dump/landfill					
Dump location in GPS coordinates of the entrance of the site	X		° ‘		
	Y		° ‘		
	Z		m		
Land Owner: Name					
Statistics Office Registration Identity					
Address					
ZIP Code					
City					
Dump owner or Operator: Name					
Statistics Office Registration Identity					
Address					
ZIP Code					
City			km		
Access road to the dump from		Highway N°			
or from		Road N°			
Access road	❑	Concrete or asphalt			-6
	❑	Stones		1	6
Distance from dump borders to the nearest populated area				0→3	0→9
What is the distance between the dump and the largest district centre or town centre?				0→3	0→-9
Total area of a dump			ha		0→-6
Active dump area (already occupied with waste)			ha	0→3	
Average thickness of a waste layer (factual)			m		
Year the dump was opened				0→3	
In case the dump has been closed, please indicate the year of closure					
Are the waste covered with land or with construction waste?	❑	Yes		0/3	
	❑	No			
Detection of **radioactivity**	❑	Yes		0/15	0/15
	❑	No			
Detection of **methane in ambient air**	❑	Yes			
	❑	No			
If yes, rate			%	0→6	
Detection of **methane in waste**	❑	Yes			
	❑	No			

[6] 040928 Grid Scoring E

Dump (landfill) name			Unit	Haz	Expl
If yes, rate			%	0→3	
Is the waste usually **burning**?	❑	Yes		0/3	
	❑	No			
Is there **biogas fire**?	❑	Yes		0/6	
	❑	No			
Does it exist **dangerous slopes**?	❑	Yes			
	❑	No			
Ratio of slope	1/			0→9	
Height			m		0→-3
Existing **piezometers** - number			m		
Depth of water	1				-1/-3
	2				-1/-3
	3				-1/-3
	4				-1/-3
River in the vicinity of the dump: Name			1	0→3	0→3
Distance from the dump			km		
width			m		
River in the vicinity of the dump: Name			2	0→3	0→3
Distance from the dump			km		
width			m		
River in the vicinity of the dump: Name			3	0→3	0→3
Distance from the dump			km		
width			m		
Visible leachates around the dump	❑	Yes		0→6	0→3
	❑	No			
Has the dump been created at the place of a former quarry?	❑	Sand		6	6
	❑	Lime		3	3
	❑	Clay		-3	-9
	❑	Granite		0	0
	❑	Other		0→3	0→-3
Presence of **unacceptable or hazardous waste**		Nature	m^3		
				0→9	
				0→9	
				0→9	
Origin of household waste (name of the main cities & districts – waste suppliers)					0 → -9
Volume of waste/year: Domestic waste from residential sector			m^3	0 → 6	0 → -15
Volume of waste/year: Domestic waste of industries collected on a contractual basis			m^3		
Volume of waste/year: Municipal waste			m^3		

Dump (landfill) name			Unit	Haz	Expl
If there's industrial waste brought to the dump: Volume of industrial waste/year			m^3		
Volume of construction waste/year			m^3		
Total volume of waste accumulated at the dump			m^3	0→6	
Reserve dump capacity for accumulation of waste			m^3		0→-9
Is there any fence round the dump?	❑ ❑	Yes No		1	-3
Are there any guardians at the dump?	❑ ❑	Yes No		3	
If yes, are the guardians present on the dump 24 / 24 h?	❑ ❑	Yes No		-3	
Are the guardians equipped with a phone?	❑ ❑	Yes No		-2	-2
Is there any weighbridge at the dump or as near to be used by trucks going to the dump?	❑ ❑	Yes No			-3
If yes, what is the distance between it and the dump?			m		
Number of bulldozers/tractors in working conditions				-2	
Number of bulldozers/tractors in non-working conditions					
Number of guardians					
Number of employees, working at the dump				0→3	
Number of tractor/bulldozer drivers working at the dump				0→3	
Approximate number of scavengers collecting certain waste components without any authorisation				0→3	
Weather conditions of the Audit					
Sun	❑				
Rain	❑				
Temperature			˚C		
Wind					
Date of the Audit					
Name of the Inspector		**Signature**			

3.4.2 Guide[7]

The principle is to make as objective and as reproductible as possible the quotation established by any inspector on a landfill. So the following table describes the value of the different criteria. For some criteria, the mark is a given figure, for example 0 for yes, 3 for no, indicated as 0/3. For other criteria, the inspector has to give his own estimation, for example form 0 to 3, indicated as 0→3.

[7] 040928 Note Scoring

The hazard of a landfill and its interest for a further exploitation are two different approaches and they are quoted differently, in aim to define priorities. So it's not incongruous if a landfill appears as hazardous and interesting for a further exploitation. It means only that studies and works will have to be done in both priorities.

Table 3: Quotation of the criteria

Scoring the hazard	Scoring the potential of exploitation
Official status	
The landfill can be passportized, registered or its status unknown. Passportized means that a minimum of studies have been done and it is noted 0. Registered means that it is controlled by the Inspection and it is noted 3. Unknown is noted 9.	If the landfill is passportized, it means normally that the conditions of the exploitation are rather good and it is noted -5.
Access road to the dump: Concrete or asphalt	
	It's interesting for the further exploitation. A road of concrete or asphalt is expensive. Note -6 if yes
Access road to the dump: Stones	
It's not so good in terms of safety for the trucks. Note 1 if yes.	As for the same reason as upper, note 6 if yes.
Distance from dump borders to the nearest populated area	
The landfill is a risk for the immediate neighbours. Note from 0 to 3 (0 for >1 km, 1 for >0.5 km, 2 for >0.2 km, 3 for <0.2 km)	The landfill is a risk for the immediate neighbours and usually it's necessary to buy the closest housings (<0.2 km). Note from 0 to 9 (0 for >1.5 km, 1 for <1.5 km, 2 for <1.0 k, 3 for >0.7 km, 5 for <0.5 km, 7 for <0.4 km, 9 for <0.2 km).
What is the distance between the dump and the largest district centre or town centre?	
A short distance should show that the landfill is inside the urban area. It is noted from 0 to 3: 0 >2 km, 1 for $\leq$2 km, 2 $\leq$1 km, 3 for $\leq$0.5 km	By the contrary, the closest it is, the most convenient it is for the reduction of the time of transportation of the waste. It is noted from 0 to -9: 0 for $\geq$10 km, -1 for $\geq$9 km, -2 for $\geq$8 km, -3 for $\geq$7 km, -4 for $\geq$6 km, -5 for $\geq$5 km, -6 for $\geq$4 km, -7 for $\geq$3 km, -8 for $\geq$2 km; -9 for <2 km
Active dump area (already occupied with waste) (ha)	

The largest it is, the most dangerous it is. Note from 0 to 3: 0 for <1 ha, 1 for >1 ha, 2 for >3 ha, 3 for >7 ha	
Reserve dump capacity for accumulation of waste (ha) (Total area of a dump - Active dump area already occupied with waste)	
	The biggest free space is interesting for the further exploitation. Note from 0 to -6: 0 for <2 ha, -1 for <4 ha; -2 for <6 ha, -3 for <9 ha, -4 for <12 ha, -5 for <15 ha, -6 >15 ha
Year the dump was opened	
Note from 0 to 3 (0 for <10 years, 1 for <20 years, 2 for <30 years, 3 for >30 years) considering that the older they are the less known they are	
Are the waste covered with land or with construction waste?	
It's a good way to secure the landfill from fires and flyings. Note 0 if yes, 3 if no.	
Detection of radioactivity	
Requires important works of protection. Note 15 if yes.	Requires important works of protection. Note 15 if yes.
Is the waste usually burning?	
Note 3 if yes	
Is there biogas fire?	
Note 6 if yes	
Does it exist dangerous slopes?	
It must be appreciated in terms of slope ratio and height. The risk exist when the slope is steeper than 18°. The hazard is proportional to the height. The auditor must note from 0 to 9 his estimation of the hazard.	For the exploitation, the higher is the layer of waste, the better it is. It is noted from 0 to -3.
Existing piezometers - Depth of water	
It's interesting to have piezometers to control the pollution of the underground water but it's not really useful for a risk assessment: only the results of the analysis should be interesting but there's so few piezometers on existing landfills that this criteria cannot be taken into account.	For the further exploitation, it's interesting to know which is the depth of the underground water. We account -1 for each piezometer and -3 when the water is <-5 m. This criterion is limited to 4 piezometers because the objective is only to classify the landfills between them.

River in the vicinity of the dump	
Rivers are a vector of the pollution of the leachate. This is noted from 0 to 3 according to the distance from the landfill and the size of the river.	Rivers are a vector of the pollution of the leachate. This is noted from 0 to 3 according to the distance from the landfill and the size of the river.
Visible leachate around the dump	
The leachate is the main pollutant of the landfills. If it flows around the landfill, it is noted from 0 to 6.	The leachate is the main pollutant of the landfills. If it flows around the landfill, it is noted from 0 to 3.
Has the dump been created at the place of a former quarry?	
It's a common practice. When it's in clay, it's perfect and it is noted -3. When it's in sand (6) or lime (3), it's less favourable. Particular cases can be noted from 0 to 3.	It's a common practice. When it's in clay, it's perfect and it is noted -9. When it's in sand (6) or lime (3), it's less favourable. Particular cases can be noted from 0 to 3.
Presence of unacceptable or hazardous waste	
Noted from 0 to 9 according to the hazard and the quantity of the waste. This criterion is limited to 3 hazardous waste because the objective is only to classify the landfills between them.	
Origin of waste (main cities & districts – waste suppliers)	
	The landfills disposing the waste of big cities are of a great interest. This is globally noted from 0 to -9.
Origin of the waste and quantities	
The bigger is the quantity of waste per year, the higher is the risk. This is globally noted (for household, commerce, municipal, industrial) from 0 to 6.	It's interesting to maintain a landfill receiving a big quantity of waste. This is globally noted (for household, commerce, municipal, industrial) from 0 to -15.
Total volume of waste accumulated at the dump	
The bigger is the quantity of accumulated waste, the higher is the risk. This is globally noted from 0 to 6.	
Reserve dump capacity for accumulation of waste	
	The bigger is the quantity of free space for waste, the better it is. It must be evaluated in volume but it's only possible to meter the surface. So this is globally noted by the auditor from 0 to -9.

Is there any fence round the dump?	
Note 1 if no	Note -3 if yes
Are there any guardians at the dump?	
Note 3 if no	
If yes, are the guardians present on the dump 24 / 24 h?	
Note -3 if yes	
Are the guardians equipped with a phone?	
Note -2 if yes	Note -2 if yes
Is there any weighbridge at the dump or as near to be used by trucks going to the dump?	
	Note -3 if yes
Number of bulldozers/tractors in working conditions	
Note -2 if there's 1 or more bulldozers in working conditions	
Number of employees, working at the dump	
Note 3 if there's no employees and 2 if there's only one	
Number of tractor/bulldozer drivers working at the dump	
Note 3 if there's no tractor/bulldozer drivers and 2 if there's only one	
Approximate number of scavengers collecting certain waste components without any authorisation	
Note from 0 to 3 (0 for <10 scavengers, 1 for <20, 2 for <30, 3 for >30) considering that these scavengers are particularly exposed to the risks	

3.4.3 Hazard assessment

La note maximale totale pour cette colonne peut atteindre 140.

Il faudra accumuler plusieurs audits de décharge avant de proposer des seuils de catégorisation des décharges dangereuses.

Enfin, cette notation n'exclut pas de décider qu'une décharge est très dangereuse sur la base d'un seul critère ou d'un seul fait. Imaginons simplement qu'il soit détecté une très forte radio-activité sur une décharge.

3.4.4 Control of the risk and carrying on with exploitation

Par le jeu des notes negatives, la notation proposée peut aller de -82 (la meilleure situation) à +72 (la pire situation). On peut grossièrement dire qu'une dé-

charge, non classée très dangereuse lors du calcul précédent, mérite que l'on s'intéresse à son avenir si elle obtient une note négative.

4 Audit of 56 landfills during summer 2004

In this part, we present the 56 audits of summer 2004. The first one presents the documents established during one audit. For the others, we present only the comments on the landfill.

4.1 Petrovskyi

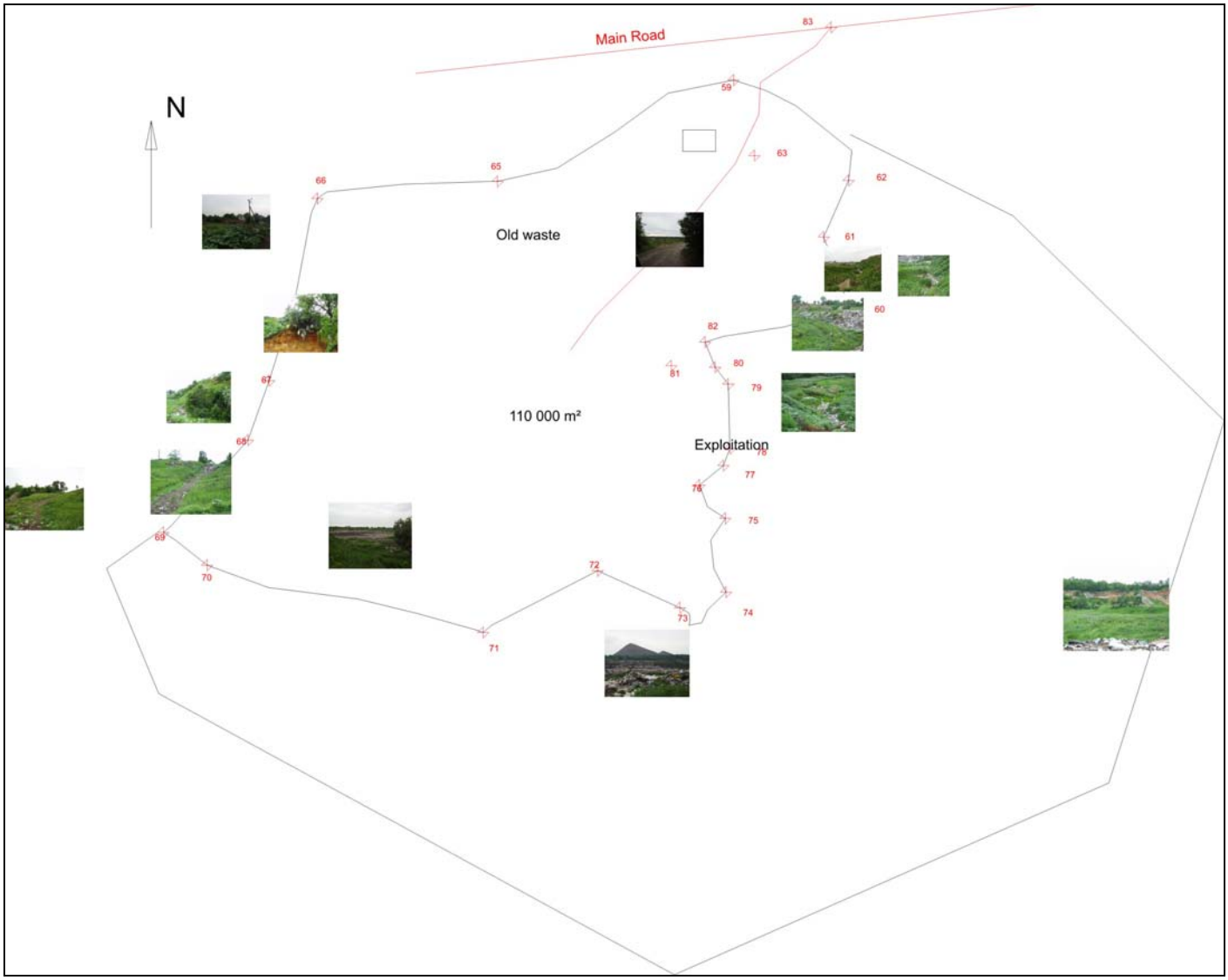
Table 4: Form of the audit of the landfill of Petrovskyi

Dump (landfill) name	Petrovskyi		Unit	Haz	Expl
Official status	❑	Passportized			
	☒	Registered		3	
	❑	Unknown			
Availability date of permits for the use of land for dump/landfill					
Dump location in GPS coordinates of the entrance of the site	E	E37° 34.642	° ‘		
	N	N47°56.538	° ‘		
	Z	181,9	m		
Land Owner: Name					
Statistics Office Registration Identity					
Address					
ZIP Code					
City					
Dump owner or Operator: Name					
Statistics Office Registration Identity					
Address					
ZIP Code					
City			km		
Access road to the dump from		Highway N°	0		
or from		Road N°			
Access road	❑	Concrete or asphalt			
	☒	Stones		1	0
Distance from dump borders to the nearest populated area			0	3	9
What is the distance between the dump and the largest district centre or town centre?				1	0
Total area of a dump		25	ha	1	0
Active dump area (already occupied with waste)		11	ha		
Average thickness of a waste layer (factual)		12	m		
Year the dump was opened		1972		0	
In case the dump has been closed, please indicate the year of closure					
Are the waste covered with land or with construction waste?	☒	Yes		1	
	❑	No			
Detection of **radioactivity**	☒	Yes		15	15
	❑	No			
Detection of **methane in ambient air**	❑	Yes			
	☒	No			
If yes, rate			%	0	
Detection of **methane in waste**	❑	Yes			
	☒	No			
If yes, rate			%	0	
Is the waste usually **burning**?	❑	Yes		0	
	☒	No			
Is there **biogas fire**?	❑	Yes		0	
	☒	No			
Does it exist **dangerous slopes**?	❑	Yes			
	☒	No			
Ratio of slope	1/1			0	0

Dump (landfill) name		Petrovskyi	Unit	Haz	Expl
Height		3	m		
Existing **piezometers** - number			m		
Depth of water	1				-3
	2				-3
	3				-3
	4				-3
River in the vicinity of the dump: Name			1	0	0
Distance from the dump			km		
width			m		
River in the vicinity of the dump: Name			2	0	0
Distance from the dump			km		
width			m		
River in the vicinity of the dump: Name			3	0	0
Distance from the dump			km		
width			m		
Visible leachates around the dump	☒	Yes		6	3
	❑	No			
Has the dump been created at the place of a former quarry?	☒	Sand		6	6
	❑	Lime			
	❑	Clay			
	❑	Granite			
	❑	Other			
Presence of **unacceptable or hazardous waste**		Nature	m^3		
Origin of waste (name of the main cities & districts – waste suppliers)		Donetsk			-9
Volume of waste/year: Domestic waste from residential sector		300 000	m^3	2	-5
Volume of waste/year: Domestic waste of industries collected on a contractual basis			m^3		
Volume of waste/year: Municipal waste			m^3		
If there's industrial waste brought to the dump: Volume of industrial waste/year			m^3		
Volume of construction waste/year			m^3		
Total volume of waste accumulated at the dump		1 000 000	m^3	3	
Reserve dump capacity for accumulation of waste		3 000 000	m^3		-5
Is there any fence round the dump?	❑	Yes		1	3
	☒	No			
Are there any guardians at the dump?	☒	Yes		0	
	❑	No			
If yes, are the guardians present on the dump 24 / 24 h?	☒	Yes		-3	
	❑	No			
Are the guardians equipped with a phone?	☒	Yes		-2	-2
	❑	No			
Is there any weighbridge at the dump or as near to be used by trucks going to the dump?	❑	Yes			-3
	☒	No			
If yes, what is the distance between it and the dump?			m		
Number of bulldozers/tractors in working conditions			2	-2	
Number of bulldozers/tractors in non-working conditions			0		
Number of guardians			2		
Number of employees, working at the dump				0	

Dump (landfill) name		Petrovskyi	Unit	Haz	Expl
Number of tractor/bulldozer drivers working at the dump				0	
Approximate number of scavengers collecting certain waste components without any authorisation			50	0	
Weather conditions of the Audit					
Sun	❑				
Rain	☒				
Temperature		16	°C		
Wind					
Date of the Audit		17/06/04			
Name of the Inspector		**Score**		**36**	**0**

Picture 1: Scheme of the landfill of Petrovskyi



4.1.1 COMMENTS

4.1.1.1 Operations

The operation of the landfill is well driven by ISTOK. The landfill is kept with 2 guardians 24/24, equipped with mobile phone.

The office of the landfill is connected to the water network (even equipped with a shower). A high voltage line is supplying the landfill which has its own transformer. Formerly existed a phone line but it is disconnected.

The lane across the landfill is in a very good state. The area of unloading is flat and clean.

About 50 people are sorting waste on the landfill. They are managed by the operator who buys the secondary raw materials and maintains the discipline.

The waste are nowadays disposed in the middle of the landfill, on a line SW-NE. The waste are unloaded on the sorting area. On afternoon, the 2 bulldozers push and compress the waste.

4.1.1.2 Problems

The landfill is a former quarry of sand. It seems that under the layer of sand, the ground is waterproof, as it is usual to find an alternation of layers of sand and of clay. The indication is that in the bottom of the quarry, there's a marsh. Directly at the bottom of the waste, it can be seen a pond of leachates.

The landfill is very close individual houses and it can be suspected that if some are equipped with wells, the leachate migrates in the sand and contaminates the wells.

There's no fence around the landfill which can be easily used as a playground for the neighbour children.

5 Results

The inventory allowed to classify the existing landfills for our two objectives: which are the most hazardous; which are interesting for the exploitation.

The results are on the following tables. These positions or notes cannot pretend to be true by themselves. It allows only to compare the landfills between themselves with a rational method. It's more interesting to consider classes of hazard and classes of interest. It's what we have tried to present with the colours.

Globally it may be considered that the red class requires urgent studies of hazard. It may be considered that the landfills in green on the two criteria should be studied in priority for the management of the transition period.

Table 5: Results of the audit

Landfills	Hazard Position	Interest Position	Haz Note	Int Note
0001 Petrovsky landfill of the city of Donetsk	50	15	43	-25
0002 Chulkovsky SDW landfill of the city of Donetsk	32	41	28	-8
0003 Bajanovskaya dump in the city of Makeyevka	56	19	54	-23
0004 SDW dump in Larino settlement of the city of Donetsk				
0005 Dump of the central subdistrict of the city of Gorlovka	35	4	31	-33
0006 Dump of Izotov settlement of Nikitovsky district of the city of Gorlovka	37	51	32	1
0007 Dobropolye city (Belozerskoye town) – SDW dump	54	53	45	8
0008 Vodiansky SDW landfill (Vodianskoye settlement of Dobropolsky district)	28	8	26	-31
0009 City dump of Drujkovka	39	23	33	-21
0010 Central SDW dump of the city of Yenakievo	39	6	33	-32
0011 SDW dump of the city of Uglegorsk (city of Yenakievo)	17	39	18	-10
0012 SDW dump of the Carl Marx settlement (city of Yenakievo)	24	52	23	2
0013 SDW dump of the city of Snejnoye – settlement of mine # 6-18	15	21	17	-22
0014 Dump of Ordjonikidze district of the city of Marioupol	35	3	31	-36
0015 Dump-like landfill of Primorsky district of Marioupol	51	21	43	-22
0016 SDW dump of the city of Debaltsevo	25	31	25	-16
0017 SDW landfill of the city of Svetlodarsk	1	15	2	-25
0018 SDW dump in the city of Konstantinovka	38	15	32	-25
0019 SDW dump of the city of Dokuchaevsk	39	30	33	-17
0020 SDW landfill in the city of Ugledar	4	19	7	-23
0021 SDW dump of the settlement Stashkovskoye of the city of Schakhtersk	21	41	20	-8
0022 SDW landfill of the city of Ilovaysk	3	14	5	-26
0023 SDW landfill of the city of Zugress	9	45	13	-4
0024 SDW dump of the city of Khartsizsk	49	25	39	-18
0025 SDW dump of the city of Soledar	9	25	11	-18
0026 SDW landfill of the city of Chasov Yar	5	13	8	-27
0027 SDW dump of the settlement of mine Donetskaya (city of Torez)	48	36	38	-11
0028 SDW dump of the settlement of mine Lesnaya (Torez)	32	53	28	8
0029 SDW landfill of the open joint-stock company "Avdeyevsky Coke-Chemical Plant"	2	6	4	-32
0030 City dump of the city of Dimitrovo	23	44	22	-5
0031 SDW dump of the city of Kirovskoye	46	12	36	-29

0032 SDW dump of the city of Jdanovka	29	34	27	-13
0033 SDW dump of the city of Artemovsk	29	8	27	-31
0034 SDW dump of the city of Seversk of Artemovsky district	20	36	19	-11
0035 SDW dump of the city of Kurakhovo of Maryinsky district	51	46	43	-1
0036 SDW dump of the city of Kramatorsk	55	2	47	-37
0037 Krasnoarmeysky city SDW landfill	47	36	37	-11
0038 SDW landfill of the city of Novogrodovka	11	39	12	-10
0039 City SDW landfill of the city of Dzerjinsk	15	8	17	-31
0040 SDW landfill of the city of Amvrosievka	45	18	35	-24
0041 SDW landfill of the city of Novoazovsk	21	33	20	-14
0042 SDW dump of the city of Slaviansk	39	1	33	-38
0043 SDW landfill of the city of Sviatogorsk	29	25	27	-18
0044 SDW landfill of the city of Krasny Liman	6	8	10	-31
0045 SDW dump of the town-like settlement Telmanovo	25	47	25	0
0046 SDW dump of the city of Komsomolskoye	49	55	39	10
0047 SDW dump of the settlement Alexandrovka	19	25	19	-18
0048 Vremevskaya SDW dumps (town-like settlement Velikaya Novoselovka)	39	56	33	26
0049 SDW dump of the city of Volnovakha	34	24	29	-19
0050 SDW dump of the town-like settlement Volodarskoye	25	43	25	-6
0051 SDW dump of the town-like settlement Mangush	9	25	11	-18
0052 SDW dump of Yalta settlement	17	35	18	-12
0053 SDW dump of the city of Selidovo	12	32	13	-15

6 Comments

6.1 Work on the field

The audit of SDW dumps of the Donetsk oblast was carried out by the Ukrainian Scientific Centre of Technical Ecology (open joint-stock company "UkrNTEK") in July-August 2004. The work was done in accordance with the SDW Landfill Reference Manual prepared by the experts of the Tacis Programme "Improvement of Solid Household Waste Management in Donetsk Oblast of Ukraine".

Landfill audit activities can be conventionally organized into three steps:

- preparation;
- visit of a SHW dump (landfill);
- processing of the data.

6.1.1 Preparation

The objective of this stage is to get a permission for implementation of the landfill audit from local executive authorities or local self-government bodies and to co-ordinate the time of a visit with the operator of a dump.

Before each trip the audit group manager used to phone to the City Mayor (most frequently), his deputies or heads of public utilities and inform them about the activities to be implemented within the framework of the Tacis Programme. Thanks to the workshops carried out in the premises of the State Department of Ecology and Natural Resources in the Donetsk Oblast, the persons in charge of sanitary cleaning of populated areas and operation of SHW dumps in cities and districts were well aware about the project. That's why in most of the cases it was not difficult to get a preliminary consent of relevant managers for implementation of the audit. Then, there was prepared a letter addressed to the City Mayor or head of the district administration with the request to permit the implementation of the dump audit. There was attached to the letter the minutes of meeting where it was stated that the implementation of such a work was entrusted to the open joint-stock company "UkrNTEK" and a questionnaire created in accordance with the standard report form of the SDW Landfill Reference Manual.

However, sometimes it was difficult to receive a permission for visiting a dump. It mainly concerns the SHW dump in the Larino settlement of the city of Donetsk. Having requested the assistance of the dump manager in auditing the dump we were advised to contact his direct boss (head of the public utility (CATP), who in his turn recommended to get in touch with his direct boss in the City Council. Finally, in response to our letter N° 25/973 as of 23.06.2004 addressed to the head of the Department of Housing and Public Utility Services of the city of Donetsk, there was received a refusal, that's why the Larino dump was never audited.

6.1.2 Visit of a SHW Dump (Landfill)

The director of the company operating a dump (or other responsible official) used to receive detailed explanations about the goals and content of the on-going activities and with his help there was filled in that part of a questionnaire that concerned general characteristics of the SHW dump (date of issue of a land use permission, legal addresses, registration number in the department of statistics, etc.).

During the audit of a SHW dump (landfill) there were used the following equipment and devices:

- GPS Garmin V
- Device for measuring the level of underground water (dipmeter)
- Digital camera
- Dictaphone

The device for measuring the level of underground water was used quite rarely as most of the dumps did not have any piezometers.

The dictaphone was used for an audio-register that contains a detailed information about each dump (landfill).

We've walked along the perimeter of each dump with a GPS device Garmin V fixing problematic zones (dangerous slopes, leachate, underground waters, industrial waste, etc.). Problematic zones were also registered with the help of a digital camera and dictaphone.

6.1.3 Processing of Data

The information was processed each day after the site visit. In parallel with that there were filled in standard report forms.

Each SHW dump (landfill) has been assigned a number:

0001 Petrovsky SHW landfill of the city of Donetsk

0002 Chulkovsky SHW landfill of the city of Donetsk

……

……..

0053 SHW dump of the city of Selidovo.

All files associated with a dump in question start with a number assigned to them.

The report about the audit includes a brief description of a dump, list of environment protection as well as sanitary and hygienic problems, a filled in standard report form, a drawing with contours of a dump and representative places (problematic points), an access road, an active zone of waste storage and images associated with points on the drawing.

The GPS used registers the points selected by the operator but also all the waypoints it takes systematically during the trip. The software provided with the GPS (Mapsource) allows to transfer to a computer (via a RS232C port) a file with all the registered data (in delimited text format) and a file with the drawing of the trip (DXF format). Then after the downloading, the text file was converted in Excel file for the treatment of the data.

It was supposed to process the DXF file with a CAD software (Designcad). In fact, the importation of the DXF files shows a distortion on the axle North-South. It seems that the software takes into account a projection of the point on a plan parallel to the axle of the earth, so at our latitude (around 48° N) it reduces the N-S dimension with a coefficient cosine 48°. So the contour of the landfill has been drawn with the coordinates of the waypoints as they appear in the Excel file.

Then all the data have been transferred to a database (Access). This database is linked with the GIS implemented in the Department of Ecology of Donetsk by the Tacis Programme in aim to constitute a geodatabase.

On the basis of audit results and expert's assessments there has been created a list of SHW dumps, the operation of which will have a minimal affect on the environment. There were also identified the dumps which should be closed in the coming years.

6.2 Practical recommendations

We have been greatly helped by the weather. The rain by itself is not a problem but it's very difficult to walk some kilometres all around a landfill when the soil is completely waterlogged. Such weather conditions forbid also to identify the flows or the ponds of leachates around the landfill.

A cover of snow should forbid to see correctly the presence of forbidden waste.

The inspectors should be well equipped with individual equipments as safety shoes or boots, gloves, and even helmet when they are near the trucks and bulldozers.

The gas analyser has not been used for this first audit because the specific cell for the measure of the methane in ambient air was not available. By the way the expert of the Tacis Programme has considered that as a large majority of the landfills used to burn the waste, the probability to find biogas was very low and decided to suppress this measures.

The radioactivity has been checked during the two first audits. Then this equipment failed. So the results for the two first landfills have not been taken into account for the table of results.