

Table 5.4 - 8 Quantity of Other Waste Produced in 1997 from SOSR Data

District <i>Region</i>	Other Waste total [t]	Disposal Method				
		Reused/ Recycled	Stored	Landfilled	Incinerated	Other
Levice	57,256.7	47,354.0	5,937.9	513.6	3,322.7	128.6
Nové Zámky	243,689.3	203,049.2	8,526.9	12,012.4	4.0	20,096.8
Zlaté Moravce	24,967.8	23,390.7	56.9	1,341.0	53.1	126.1
<i>Nitra Region / part</i>	<i>325,913.8</i>	<i>273,793.9</i>	<i>14,521.7</i>	<i>13,867.0</i>	<i>3,379.8</i>	<i>20,351.4</i>
Banská Bystrica	117,276.4	95,565.6	862.4	17,211.8	443.8	3,192.8
Banská Štiavnica	12,828.7	3,102.2	8.5	9,183.7	5.3	529.0
Brezno	383,430.9	330,175.6	24,266.3	20,281.6	38.9	8,668.5
Detva	5,504.7	3,570.7	12.1	47.4	349.2	1,525.3
Zvolen	62,930.9	26,159.7	91.1	4,935.4	30,856.6	888.1
Žarnovica	22,505.7	22,013.9	6.2	434.8	0.0	50.8
Žiar nad Hronom	17,020.0	9,482.1	3.7	6,353.1	1,170.8	10.3
<i>Banská Bystrica Region / part</i>	<i>621,497.3</i>	<i>490,069.8</i>	<i>25,250.3</i>	<i>58,447.8</i>	<i>32,864.6</i>	<i>14,864.8</i>
<i>Hron River Basin (aprox.) [%]</i>	<i>100.00%</i>	<i>80.63%</i>	<i>4.20%</i>	<i>7.63%</i>	<i>3.83%</i>	<i>3.72%</i>
<i>Hron River Basin (aprox.) [t]</i>	<i>947,411.1</i>	<i>763,863.7</i>	<i>39,772.0</i>	<i>72,314.8</i>	<i>36,244.4</i>	<i>35,216.2</i>

The first important point to note is that in Table 5.4-8, the total estimate for Other Waste production is nearly 950 000 t per annum. Even if this estimate is not totally accurate, because it has been derived from an incomplete return of waste statistics questionnaires, then it is likely to be an underestimate, rather than the reverse. Consequently, as much as 1 000 000 t of waste could be generated in the Study Area, each year, for which the SAZP statistics make no allowance. This is a large quantity of waste not to take into consideration, when planning for future disposal needs. It should not be ignored.

Reference to Table H.1-1 (Annex H) shows that a large proportion of Other Waste types, consist of agricultural and process wastes. Table 5.4-8 reveals that over 80% of all Other Waste produced is recycled or reused, largely due to the fact that it is agricultural in origin. Thought should therefore be given to removing such data from the Waste Statistics, or at least clearly distinguishing between waste that requires controlled disposal, as opposed to being recycled. Focusing the waste production statistics would therefore be useful.

Table 5.4-8 also shows that there is only approximately 184 000 t of Other Waste to dispose of annually, by means other than recycling or reusing. Of this, 72 314 t was landfilled, which although it only represents an additional 7.4% relative to the SAZP figures for landfilled waste, it is still a sizeable quantity. The quantity of Other Waste which requires to be incinerated, however, namely 36 244 t, is far greater than the 17 888 t identified from the SAZP data.

Given that there had been considerable comment about the inadequacy of incineration facilities in the Study Area, it is significant that such a quantity of material should not be accounted for in the SAZP statistics.

Table 5.4 - 9 Total Quantity of Waste Produced in 1997 from SOSR Data

District <i>Region</i>	Waste total [t]	Disposal Method				
		Reused/ Recycled	Stored	Landfilled	Incinerated	Other
Levice	252,597.0	182,826.3	46,035.2	7,868.2	3,488.6	12,378.7
Nové Zámky	837,002.7	757,043.9	16,305.8	28,988.1	446.4	34,218.5
Zlaté Moravce	163,394.7	121,129.5	9,586.9	8,607.5	207.8	23,863.0
<i>Nitra Region / part</i>	<i>1,252,994.4</i>	<i>1,060,999.7</i>	<i>71,927.9</i>	<i>45,463.8</i>	<i>4,142.8</i>	<i>70,460.2</i>
Banská Bystrica	286,271.9	224,432.6	2,211.6	35,380.0	733.0	23,514.7
Banská Štiavnica	23,795.8	12,930.1	63.1	10,072.1	13.1	717.4
Brezno	641,475.1	549,902.9	26,813.4	25,933.3	4,147.9	34,677.6
Detva	36,876.7	32,091.5	42.6	574.0	427.5	3,741.1
Zvolen	364,949.8	210,390.7	212.0	8,948.5	31,072.2	114,326.4
Žarnovica	47,784.8	28,643.5	28.4	18,816.5	26.9	270.5
Žiar nad Hronom	112,127.4	36,320.6	60.4	72,851.0	1,227.2	1,668.2
<i>Banská Bystrica Region</i>	<i>1,513,281.5</i>	<i>1,094,711.9</i>	<i>29,431.5</i>	<i>172,575.4</i>	<i>37,647.8</i>	<i>178,915.9</i>
<i>Hron River Basin]</i>	<i>100.00%</i>	<i>77.93%</i>	<i>3.66%</i>	<i>7.88%</i>	<i>1.51%</i>	<i>9.01%</i>
<i>Hron River Basin</i>	<i>2,766,275.9</i>	<i>2,155,711.6</i>	<i>101,359.4</i>	<i>218,039.2</i>	<i>41,790.6</i>	<i>249,376.1</i>

Table 5.4 - 10 Comparison of Waste Disposal Data from SOSR and SAZP (COH)

Selected Districts	Hazardous Waste total [t]		Special Waste total [t]	
	SOSR	SAZP	SOSR	SAZP
Banska Bystrica	26,076	42,127	142,920	329,343
Banska Stiavnica	718	907	10,249	6,314
Brezno	31,788	31,970	226,256	48,215
Levice	13,401	16,469	181,940	190,632
Nove Zamky	15,139	793	578,174	46,713
Zarnovica	18,173	41,839	7,107	26,506
Ziar nad Hronom	40,522	132,672	54,586	247,741
Zlate Moravce	5,314	3,965	133,113	25,084
Zvolen	4,091	223,803	297,928	413,027
	Hazardous waste total [t]		Special waste total [t]	
	SOSR	SAZP	SOSR	SAZP
Study Area [t]	164,079	503,701	1,654,786	1,349,371
Percentage Comparison [SO:SAZP/SAZP:SOSR]	32.57%	306.99%	122.63%	81.54%

In comparing the data from the two sources (Ref. Table 5.4-10), it can be seen that there is reasonable similarity in the overall figure for Special Waste, although there are some massive variations for individual Okres. For example SOSR identifies Nove Zamky as producing 578 174 t of Special Waste in 1997, whilst SAZP calculated that the Okres produced only 46 713 t.

Similar variations exist for Brezno and Zlate Moravce. Conversely SAZP figures are much higher for Ziar nad Hronom (247 741 t) as opposed to SOSR figures of 54 586 t. Similar situations exist for Banska Bystrica and Zvolen. In spite of these variations, the two sets of figures for overall quantity of Special Waste produced are within approximately 20% of each other. What is of interest and concern, is the basis for the major variations within Okres statistics.

The situation is even more noticeable for the Hazardous Waste production with total production figures of 164 079 t and 503 701 t for SOSR and SAZP sources respectively. The majority of the figures are not hugely dissimilar, with the exceptions of Ziar nad Hronom (40 522 t : 132 672 t) and Zvolen (4 091 t : 223 803 t) for SOSR and SAZP data respectively.

The above figures result in SAZP statistics showing a figure for Hazardous Waste approximately 307% greater than the SOSR production rate. No clear explanation can be given for these variations. The data are not clear enough, nor from a sufficiently large temporal database, to identify them as discrepancies, but what they do show is that the basis for collecting waste production statistics is not satisfactory. Whilst this is not good purely from a data collection viewpoint, it is potentially far more significant in the forward planning of waste disposal requirements, within the framework of both the national and regional WMPs.

The variations in the data are illustrated graphically in the Supporting Report Annex H. (Figures H.2-1 to H.2-3).

The Interim Report contained some information regarding the municipal waste production per capita for the Study Area. The data used, however, contained statistics for waste sub-type 93104 (waste of communal waste character), which is not strictly in the communal waste category (WT 91). As indicated above, the sub-type 91104 (waste from septic tanks and sumps) has also not been included in the overall calculation of municipal waste, presented in table 5.4-3, due to its liquid nature. If it were to be included, then its dry weight value would be 24 420 t according to the Banska Bystrica WMP (Ref. 15-2). This would give a final production figure of 315 562 t of municipal waste, based upon WT 91.

It is believed that there is an element of confusion in the figures used in the Interim Report, (Table 6.6-11, p 6-82), which prevents any meaningful comparison from now being made. Consequently, the per capita waste production figures have been re-worked from the RISO database, (Table 5.4-11), excluding the municipal septic tanks and sumps, and waste of

communal waste character.

Table 5.4 - 11 Municipal Waste Production per Capita per District of Study Area(1)

District	Inhabitants in Study Area ⁽²⁾	Municipal Waste Production [t] ⁽³⁾	Waste production [kg/year] per capita
Banská Bystrica	113 182	134,464	1,188
Banská Štiavnica	14 473	6,067	419
Brezno	65 535	2,394	37
Detva	31 792	4,947	156
Revúca	1 292	295	228
Ziar nad Hronom	48 506	51,981	1,072
Zarnovica	28 344	22,755	803
Zvolen	67 490	68,237	1,011
<i>Banska Bystrica Kraj</i>	370 614	291 140	785
Levice	98,415	74,341	755
Nové Zámky	40,109	852	21
Zlaté Moravce	21,721	10,044	462
<i>Nitra Kraj</i>	160,245	85,237	532
<i>Study Area Total</i>	530,859	376,379	709

Notes: (1): Municipal waste production figures for Study Area
 (2): Inhabitants data adjusted according to Interim Report , Table 4.1-2
 (3): RISO database derived

As with the analysis made for the Interim Report, the figures for the quantity per capita of waste produced, are extremely variable, based on the RISO statistics. No firm conclusions can be drawn from the data, since there is no clear explanation for the wide variations. It may be that more rural areas such as Brezno, make more use of the waste produced, for example the organic fraction of the waste is recycled, composted or otherwise reused. However, the production rates for Brezno appear so low, that the figures have to be suspected as not being entirely accurate. Discussions with the Brezno Okres Environment Department suggest that there is a great deal of fly-tipping in the Brezno area, due to the high cost of controlled waste disposal at the local landfill site. This may be a contributory factor to the low official figure for waste produced.

The other data sets that needs to be questioned are Nové Zámky, where it is believed that the quantity of waste derived for the Okres is too small, and Zlaté Moravce. In the case of the latter, it is probable that both the population figures and the waste production figures are too high, relative to the section of the municipality that is actually within the Study Area boundary.

Heavily built-up areas, such as Banska Bystrica and Zvolen, with largely urbanised populations, will be unable to make use of waste and may also have more affluent life styles. The larger figures for such areas are therefore to be expected. There may also be a difference in the

effectiveness of community waste recycling systems in the various municipalities. Observations for Banska Bystrica suggest that the initial success of the segregated waste reclamation system is starting to downturn, as Government subsidies have been removed from the scheme.

The table suggests major differences between the Okres. Unfortunately, the data available to the study are no nearer to explaining these differences, than during the Interim Report period. However, if closer inspection suggests that there are valid reasons for these variations, then there is scope to examine why, for example, Brezno has such a low per capita waste output. Perhaps then the remaining Okres could learn lessons from the activities of the municipal authorities in the area.

(4) Old Environmental Loads

The term 'old environmental load (OEL)' is given to all sites where waste material, as defined by present day classification, were deposited prior to the introduction of the Waste Act 283/1991. Up to this time, 'waste' was not recognised as such, nor was it defined in law. OELs were first registered in 1992/93 and a database (RSO – Register of Waste Sites) was developed. The Geological Survey of Slovak Republic (GSSR, Department of Geological Record), is responsible for its development and update. The database identifies approximately 550 sites for the Study Area, and is presented in Annex H (Table H.1-1). It should be noted, however, that the Banska Bystrica Kraj WMP (Ref 15-6), identifies 768 old waste sites in Banska Bystrica alone.

The database, details of which are given in the Annex, makes an attempt to identify the quantity of waste contained within each site. It is not clear if these data are accurate, given that some of the sites have been established as long ago as 1920, although the majority commenced operation during the 1970's and 80's.

Approximately 290 of the sites in the Study Area are due for reclamation and a further 200 for removal. To date, 83 sites have been reclaimed or removed up to 1995, according to the Okres' Waste Management Plans (WMPs, Ref 15-7 through 15-16), although Banska Bystrica Kraj notes that 151 sites had been reclaimed up to the end of 1996. The National WMP (Ref. 15-1) suggests that at least 4 OELs should be removed or reclaimed by each district in the period from 1997-2000, and that a further 6-10 OELs are removed between 2000 and 2005.

Due to financial restrictions, it was reported to the Study Team from a number of Okres and

Kraj offices, that the record of OELs was not kept up to date, although the requirement to maintain the system still exists. If this is true throughout the Study Area, it would be unfortunate, since some of the sites could have serious environmental implications. It would seem appropriate, therefore, to identify those facilities still remaining unreclaimed or untreated, in the Study Area, and to make as objective an assessment as possible, of the quantity and nature of their content. Identification of ownership should also be made wherever possible, to assist in securing funds for reclamation works. This is a problem area and will mean that a proportion of the sites will require State funding in order to effect reclamation.

Following such an exercise, a recommended priority listing should be drawn up for the most cost-effective site reclamation or rehabilitation programme, where priority is given to the those sites representing greatest environmental risk. Given the limited funding available for such an exercise, discussions between Okres' offices would be useful, under the auspices of this REMP. Use could be made of GIS databases, such as the Landfill Suitability Maps (Ref.Map 5.4-1) originated by GSSR to assist municipal authorities and private developers in the identification of sites which might be suitable for constructing landfill facilities. They also identify those areas not suitable for such facilities.

Details of the major OELs and major waste disposal features with environmental implications for the Study Area, are provided in Section 5.4.2 (1).

(5) Waste Management Practices

1) The main forms of waste treatment identified in Table 5.4-4 included:

- Landfill;
- Recycling/reuse;
- Storage;
- Treatment;
- Incineration.

These are discussed in more detail below, with respect to the main features of each methodology.

2) Landfills

The prevailing waste management practice in Slovakia is one of waste deposition in landfills, mainly for economic reasons. Legislation was enacted in 1992 (Order No. 606/92) to define

proper landfill design, requirements for monitoring and waste management and monitoring responsibilities. Proper landfill design requirements correspond with those for Western Europe and the most recent site that has been developed at Salkova, Banska Bystrica, is as good as virtually any site in the European Union. Provided that the operation of these sites matches the initial design and construction standards, then safe long-term disposal of landfilled waste should be expected – though at a cost

In Slovakia, landfills are divided into three “construction classes” with regard to the properties of the waste coming to the landfill. In general, if the geological characteristics of the subsurface layers are adjudged adequate, then no sealing layer, or liner is required. However, if any aspect of the characteristics of the site do not meet regulatory specifications, then lining is required.

Each type of waste, prior to disposal for the first time in the landfill, is tested by the so-called ‘leaching test’. According to the results of the leaching test, the waste is divided to 4 leaching classes - class I, II, III or IV:

- Leaching Class I waste is inert and can be deposited in the landfill of the 1st Construction Class, where no sealing barrier (lining) is required;
- Leaching Class II waste can be deposited in the landfill of the 2nd Construction Class, [where linings are only required if the permeability of the ground is $>1 \times 10^{-7}$ m/s];
- Leaching Class III waste is reactive and may degrade bio-chemically, producing leachate of a potential polluting nature, and must always be deposited in Construction Class III landfills. Such landfills require a sealing barrier where the permeability of the underlying layers $>1 \times 10^{-9}$ m/s, a leachate collection system and biogas collection/dispersion system, with compaction and intermediate as well as final cover being required;
- Leaching Class IV waste has to be processed until it reaches the properties of a lower leaching class or be deposited in a specially designed landfill.

Municipal waste, because of its variability and partially hazardous content, is considered *a priori* as a waste of Leaching Class III, according to Order No. 606/92. No leaching test is required for municipal waste as all such wastes must be deposited in a landfill of the Construction Class III. Order No. 606/92, which contains basic requirements for landfill design, has been amended by Guideline No. P-1/93, together with newly issued Slovak Technical Standards. A list of the associated Slovak Technical Standards for landfill design and operation are presented in Annex H, Section H.3.3.

As there were no existing landfills which met these newly created legislative standards, old

landfills have been allowed to operate under special conditions, issued by the Environmental Departments of Okres Offices. The deadline for ceasing operation under such "special conditions" is given as July 2000, after which all the operating landfills have to be properly designed and operated. Those not meeting the regulatory requirements will have to close. Whether this will actually happen in practice will remain to be seen, as the financial implications of closing a large number of sites throughout the country could have a major impact on local waste disposal arrangements.

Leachate management in landfills is a issue which will need to be addressed for older operational sites. At present, under Order No. 606/92 on Waste Handling, leachate is permitted to be 'treated' by recycling through the landfill. Frequent recirculation eventually increases the concentration of organic and inorganic pollutants, such that it becomes untreatable, even at a WWTP. The site at Banská Bystrica (Salkova) has a purpose built effluent treatment facilities, but this is the exception in Slovakia. Provision of such facilities increase the capital and hence operational costs of new sites, making them initially uncompetative with the older operations. However, under influence of legislation that will be needed for accession to the EU, this situation will change, provided that it is fully implemented.

Integrated Pollution Prevention and Control (IPPC) and the EU Directive on the Landfill of Waste [1999/31/EC] (Ref.15-17) will require full treatment of effluents such as landfill leachate. In addition, the latter does not permit the co-disposal of municipal solid waste with industrial waste and there will should also be control of the quantity of biodegradable materials that are sent to landfills. Design and operation of sites such as Salkova will become the norm throughout the EU, so in its seeking to join the Union, Slovakia will be obliged to enforce the above regulations. The financial implications of such requirements will have to be taken into account when planning future waste disposal facilities.

3) Recycling and Reuse

Improvement in the reuse and recycling of wastes is a major goal of all the WMPs from national to Okres level. Industry is already committed to recycling wherever possible, and as already noted, major categories of wastes of agricultural origin are also reused as fertiliser, such that they have been removed from a 'waste' classification. Most of the reused waste is in the 'Other Waste' category whilst only relatively small percentages of 'Special' and 'Hazardous' waste are reused. Nevertheless, this still represents significant quantities of waste, such that for Banská Bystrica, 136 829 t of Special and Hazardous wastes were reused in 1995 (Ref. 15-2).

Significant amounts of scrap iron, wood debris, ash, cinders and material from construction activities are reused. Paper and glass are also utilised, for which some separation of municipal refuse takes place. However, the general reports from industry and the waste management authorities, is that there is has been a decline in the amount of recycled material being obtained from such sources. It is suspected that the lack of financial support from central government is causing municipal authorities to take less interest in recycling, as it requires costly separate collection, additional waste receptacles, greater use of man-power to effect collection and marketing of the reclaimed material.

Given that Banská Bystrica Kraj reports that paper processing facilities in Harmanecké paper mills cannot obtain enough locally resourced scrap material and has to rely upon imported waste, this should indicate that there is a market to be tapped, if it can be organised – and initially funded. However, it should be noted that Germany and Austria are ‘dumping’ recycled paper in Slovakia, at no-cost to the consumer, probably as a means of supporting their own recycling industry. Consequently, it is very difficult to recover the costs of collection, sorting and treatment that are required for community based projects.

Heightening of public awareness in respect of the recycling industry, is something which needs to be improved throughout the Slovakia, let alone within the Study Area, if greater reuse is to be made of utilisable elements of municipal waste. Studies undertaken by the Agricultural University of Nitra (Prof. Húska pers.com.) have shown that, provided recycling/waste collection schemes are organised with co-operation and agreement of the local communities and are suitably managed, there is a better chance of success than if the process is merely dictated by the municipal authority. One of the keys to success is using people who would be otherwise unemployed and are hence on state support, but the main issue is to be able to demonstrate that there is a community gain from the revenue of waste collected and recycled. Provided that tangible benefits can be demonstrated, then there is a greater interest and hence involvement of the local communities.

It has to be recognised that such a system does not function without the help of the municipal authorities, in terms of collection and sorting of waste etc, but given the commitment of the Okres and Kraj WMPs to increase the percentage of wastes recycled, then such involvement and financial support will have to be forthcoming in the future. If it can be shown that there is a beneficial effect on the quantities of waste that then need to be landfilled, the long term beneficial effects may prove to be cost-effective.

4) Storage

There are a number of situations where waste may be stored, usually on the premises of the producers. In order to do this, the need must be proved and a number of specific conditions must be met. In some cases, such as PCBs where there is no approved disposal facility in Slovakia, storage is the only way of handling such wastes. This is until such time as either a suitable incineration facility is constructed in the country, or the waste is exported. Such long-term storage requires special dispensation, however. Only approximately 1.3% of wastes are handled in this fashion within the study area.

5) Treatment of Wastes

Approximately 11.6% of waste from the Study Area is treated by physico-chemical, biological or other means, according to the latest RISO figures. There are a number of specialist organisations licensed to undertake waste treatment, particularly for chemically contaminated materials. Muds contaminated with halogenated hydrocarbons and oil based wastes are typical of wastes that require treatment, there being a total of 11 organisations within the Banská Bystrica Kraj.

6) Incineration

At present, less than 1% of special and hazardous waste is disposed of by incineration. Much of this is industrial in nature, with medical wastes representing the other major category. There is concern about the performance of all types of incineration in the Study Area, with most plants being reported as operating below standard, relative to the emissions performance criteria for Slovakia. However, medical incinerator performance is of greatest concern.

A new medical incinerator has been constructed at Roosevelt Hospital in Banská Bystrica, but at the time of site inspection in June 1999, the plant was still waiting to be commissioned. It is understood that the delay in making the plant operational was because no similar facility has been commissioned elsewhere in Slovakia, the relevant authorities could not issue an appropriate license. It is understood that the facility was due to become operational in September 1999, but because of supplier problems, it is still not working at the time of writing this report. However, it is anticipated that the situation with respect to the totally sub-standard operation of the existing facility, will improve in the near future, once the facility is commissioned.

The operational condition of the existing incinerator at the hospital could only be described as atrocious in all respects. This included combustion performance, waste storage and handling and operator health and safety issues. If other medical incinerators (6 in Banská Bystrica, Ref.15-2) are operated in a similar fashion throughout the study area, then government and municipal environmental authorities are right to be concerned about such operations. A radical review and improvement of the situation is urgently required.

The operation of the medical incinerators in the Banská Bystrica region do not conform to emission limits introduced in 1998 (Ref. 15-2). The costs that would be involved to make the units operational or to construct modern replacements, so as to meet emission performance standards represents a major restriction to the wider use of incinerators for waste disposal purposes. Accession to the EU, with the requirements for IPPC will not make the situation any easier. It is unlikely therefore, that the figures for waste burnt at incinerators will increase dramatically in the Study Area, although the new medical incinerator at Banská Bystrica may become a major regional point for disposal, perhaps for the whole Study Area or even further afield. The implications of transportation costs and other logistical issues would have to be investigated, before Banská Bystrica could be considered as a focus for medical waste disposal, together with the design capacity of the plant and its long term utilisation programme.

With respect to other major incinerator facilities, a hazardous waste unit is operated by Petrochema Dubová a.s. This is used for the destruction of wastes produced at the plant and also from external sources. Approximately 20% of waste burnt comes from other industrial sources.

5.4.2 WASTE DISPOSAL SITES – LOCATION/DISTRIBUTION AND STATE

(1) Old Waste Sites

The major database for old waste disposal sites in Slovakia was prepared by GSSR, mainly during 1992-93. The list is physically large and is therefore contained in Table H.2-1 of Annex H of the Supporting Report and shown diagrammatically in Map 5.4-2. The situation has changed considerably since the database was produced, but it has not been updated, at least in its digital format. Consequently, it may not be complete, as new landfills have been built and some active sites from 1992 have been closed, reclaimed or even removed.

The table gives details of the approximate quantity of the fill material, based upon given dimensions and depth of fill. However, there is no information with regards the content of the

material, so that no judgement can be made of the environmental risk that is associated with individual sites. It will be noted that there are also very few details of site owners (Ref. Table H.2-1, Column 11 – COM_CODE). In most instances, this will mean that liability cannot be attached to any one party, so that recovery of the cost of reclamation or treatment may not be feasible.

Based on the location of the sites, some attempts have been made to assess the likelihood of contamination emanating from the source and its potential affect on groundwater or surface streams. It will be seen that there are a number of sites that have probably caused contamination of both ground and surface water resources, although where there is a perceived problem, it is unusual for both types of resource to be affected. Proximity to the Hron River is influential in suggesting if contamination is likely or not. However, there are no further data to confirm the likelihood or possible extent of any pollution. Supporting explanations are provided in Annex H, in Tables H.2-2 to H.2-5.

According to information from municipal authorities, and in keeping with government policy, a large number of the identified old waste sites in the Study Area have already been reclaimed or removed. However, the study has not been able to identify where the majority of these reclaimed sites are, nor how they have been cleaned-up. A few of the locations are well known, such as the old Soviet Army and Military Training Area in Lešt. In such cases, the state Environmental Fund has provided major subsidies for clean-up, but this is a finite resource, and cannot be expected to pay for all clean-up operations. The major sites are shown on Map 5.4-2, together with the OELs.

It is important for the municipal authorities to investigate the full extent of old waste sites in their respective areas, in order to obtain details of these OELs, with a view to prioritising the reclamation needs. Those sites determined to pose the greatest environmental risks should be removed or treated first. Recommendations were given in the Interim Report (Ref. 3-12, Section 9.4.5 (1)) which remains valid regarding the nature of site investigations to identify and quantify the nature of the wastes contained within these old sites.

Financial considerations should also be taken into account so that some form of cost-benefit can be determined when trying to develop a prioritisation for which sites would be best to remove. The assessment could also use the GSSR landfill suitability map (See Map 5.4-1), which indicates areas that are unsuitable for the location of landfill sites, by virtue of environmental vulnerability, amongst other parameters. The most important old environmental burdens,

contaminated area connected with waste disposal activities, are described in more details in Annex H.

Other specific OELs of concern include mining slag heaps and tailing ponds produced by processing plants. Banská Štiavnica and Kremnica (Ziar nad Hronom District) have a long-term history of underground mining for gold, silver and Cu - Pb - Zn ore. For economical reason, mining in these areas ceased at the beginning of 90's, as was mining in Malachov mercury mine (Banská Bystrica District). In addition, several historical mining sites are known, mostly within the upper part of River Hron Basin, eg Špania Dolina, Staré Hory (both Banská Bystrica District) and Zubietová (Brezno District), where ore veins were mined mainly for copper.

Mining issues are addressed by the Mining Act (Act No. 44/1988 as amended by the Act No. 498/1991). Remnants of mining activities deposited in slag heaps and remains of ore/industrial minerals tailing ponds are not considered to be waste and such tailing ponds are treated like water management facilities (they are managed and controlled according the Water Act No. 138/1973). In these cases the waste legislation cannot be utilised.

This does not mean that such facilities cannot represent potential (or real) environmental danger. The main features of environmental concern include the following tailing ponds and rock heaps within the River Hron Basin:

- Banská Štiavnica surrounding a) Sedem Zien (= Seven Women) tailing pond, b) Lintich tailing pond and slug heap, c) Banská Belá - Šobov waste quartz rocks heap;
- Špania Dolina processing plant and its tailing pond (mercury processing) and waste heap (talc processing);
- Kremnica surrounding - tailing ponds in Kremnica - Horná Ves (gold processing waste).

The list also includes Vajsková antimony processing plant with its associated hazardous waste slag heap and Ziar nad Hronom sludge fields arising from aluminium processing. These and other sites are detailed further in the Annex H of the Supporting Report.

(2) Operational Facilities

1) Landfill Sites

There is no database, with co-ordinates, for the landfills approved since the original GSSR database on waste sites was created. Consequently, a list of the recent licensed landfill sites has been prepared for the Study Area, (Table 5.4-12), based upon data contained in the Okres

WMPs. Co-ordinates are being prepared and the locations are shown in Map 5.4 - 3. The majority of these sites are Construction Class III, licensed without condition, for the receipt of Special, Hazardous and Other Wastes. Waste types received are shown in last section of the table.

Those sites operating with 'Special Conditions' should be closed by July 2000, based upon the requirements of the Waste Act to have controlled sites only in operation after that date. There are no calculations available of the amount of usable void space for these sites, so it has to be assumed that the licence dating takes account of the potential capacity of the facilities. It is interesting to note that the most modern of the sites, namely Salkova, Banská Bystrica, only has a licence until the end of 1999. This is assumed to be a temporary licence, which operates until the leachate treatment system has been fully commissioned. If this is not the case, then further clarification should be sought, as this is the most modern and well-constructed site in Slovakia, and is equivalent to the best sites available throughout the EU.

This approach to closure of unlicensed or 'Special Condition' sites will also be required if accession to the EU is pursued, since the Landfill of Waste Directive will place significant demand upon landfill design and operational performance in the future.

2) Incinerators

The main existing incinerators are shown in Table 5.4-13. These have been discussed already under Section 5.4.1,(5), 1), so that the table is given here for reference. It does not include all small medical incinerators, which have only limited capacity. The operation of all the units appears to be poor or unacceptable, so the commissioning of the Roosevelt Hospital facility will hopefully mitigate the situation.

Table 5.4 - 12 List of Existing Landfill Sites in Study Area(1)

DIS CODE	NAME	CADASTER	OWNER / OPERATOR	X (JTSK)	Y (JTSK)	WS CODE	OP STATUS	TILL	CLASS	IMPORTANCE	WASTE TYPE	H	O	S
BB	Lom Rakytovce	Banska Bystrica - Rakytovce	Prefasol Vikanova	1234300	419900	No	Licensed		1	Local	IW	N	Y	Y
BB	Salkova - Skradno	Banska Bystrica - Salkova	podec Onyx KROH Banska Bystrica	1227400	412000	No	Licensed	31-Dec-99	3	Regional	MW	Y	Y	Y
BR	Ekolog Sikov	Brezno	Ekolog Brezno	1224500	378600	No	Licensed	31-Dec-00	3	Regional	MW	Y	Y	Y
BR	Sikov	Podbrezova	Zelezarnie Podbrezova	1221700	389600	3940	Special Conditions	31-Jul-00		Local	IW	N	Y	Y
BR	Stolicno	Surniac	Obec Surniac	1221450	343850	3934	Special Conditions	31-Jul-00		Local	MW	Y	Y	Y
BS	Principiac	Banska Stavnica	Technicke sluzby mesta Banska Stavnica	1257350	436650	3895	Licensed	31-Dec-10	3	Local	MW	N	Y	Y
DT	Hrinova - Fangova	Hrinova	Mesto Hrinova	1246050	389750	3089	Special Conditions	31-Jul-00		Local	MW	N	Y	Y
DT	Studenec	Detva	Technicke sluzby mesta Detva	1249350	399850	3085	Licensed	31-Jul-00	3	Local	MW	N	Y	Y
LV	Kalna nad Hronom	Kalna nad Hronom	Kalna Kalna nad Hronom	1279100	473600	No	Licensed	31-Dec-25	3	Regional	MW	Y	Y	Y
LV	Tekov - Sandorhalma	Novy Tekov	Lobbe Tekov	1280300	472600	No	Licensed	31-Dec-26	3	Regional	MW, IW	Y	Y	Y
LV	Zelezovce	Zelezovce	Verejnoprospesne sluzby Zelezovce, zdruzenie obci	1302450	461000	7787	Licensed	31-Dec-23	3	Regional	MW	N	Y	Y
NZ	Kolta	Kolta	Komeko	1303450	476150	5047	Licensed	31-Dec-06	3	Regional	MW	Y	Y	Y
ZC	Boritra	Nova Bana	Technicke sluzby mesta Nova Bana	1259300	458950	3863	Licensed	31-Dec-08	1	Local	IW	N	Y	Y
ZC	Nova Bana	Nova Bana	Izornat Nova Bana	1281950	457970	3871	Licensed	31-Dec-99	1	Local	IW	Y	Y	N
ZC	Tekovska Breznica - Luffov	Tekovska Breznica	Obec Tekovska Breznica	1265450	461050	4031	Special Conditions	31-Jul-00		Local	MW	N	Y	Y
ZH	Kremnicke Bane - Ovcin	Kremnicke Bane	Technicke sluzby mesta Kremnica	1226850	436000	3877	Licensed	31-Dec-06	3	Regional	MW	Y	Y	Y
ZH	Bzenica - Uhlisko	Bzenica	Bzenex Bzenica	1250100	448640	4060	Licensed	31-Dec-10	3	Regional	MW	N	Y	Y
ZH	STKO Horne Opatovce	Horne Opatovce	Technicke sluzby s.r.o. Ziar nad Hronom	1246550	440950	3891	Licensed	31.XII.06	3	Regional	MW	N	Y	Y
ZH	ZSNP	Horne Opatovce	ZSNP Ziar nad Hronom, Zavod energetickeho hospodarstva	1246400	441200	No	Licensed	31-Dec-12	3	Regional	IW	Y	Y	Y
ZV	Zvolenska Slatina	Zvolenska Slatina	Spolocnost Pohronie Zvolen (Marius Pedersen Trencin)	1245650	412150	3163	Licensed	1-Jul-04	3	Regional	MW, IW	Y	Y	Y

Table 5.4 - 12 List of Existing Landfill Sites in Study Area (2)

DIS CODE	NAME	REMARK	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25	W26	W27		
BB	Lom Rakytove		17	31	51	58	91																								
BB	Saikova - Skradno		11	12	14	15	17	18	31	35	41	43	53	55	57	58	59	82	83	91	93	94									
BR	Ekolog		11	12	14	15	17	18	19	31	35	39	42	43	51	53	54	55	57	58	59	82	83	91	93	94					
BR	Siktor		31	91																											
BR	Stolicno	Only for the Sumiac municipality	91																												
BS	Principiac	Low operational standard	11	15	17	31	58	82	91																						
DT	Hrinova - Fangova		11	31	57	82	83	91																							
DT	Studenec		11	14	15	17	18	31	57	58	82	83	91																		
LV	Kalna nad Hironom	Very close to Tekov - Sandorhalma																													
LV	Tekov - Sandorhalma																														
LV	Zeliezovce	Very close to Kalna nad Hironom																													
NZ	Kolta																														
ZC	Borna		31																												
ZC	Nova Bara	In collision with the proposed highway	31	59	91	94																									
ZC	Tekovska Breznica - Luftov		31	91																											
ZH	Kremnické Bane - Ovcin		11	12	14	15	17	18	31	35	57	58	59	81	82	83	91	93													
ZH	Bzenica - Uhliksto	Used for the disposal of MW from Zamovica District, low operational standard	11	17	31	57	91	94																							
ZH	STKO Horne Opatovce	One site together with ZSNP landfill	31	91																											
ZH	ZSNP		11	12	14	15	17	18	31	35	39	41	42	43	51	52	53	54	55	57	58	59	82	83	91	93	94				
ZV	Zvolenska Slatina		11	12	13	14	15	17	18	19	31	35	39	41	42	43	51	52	53	54	55	57	58	59	82	83	91	93	94		

NR	NAME	EXPLANATION	TERMS
1	DIS CODE	District Code	
2	NAME	Landfill Name	
3	CADASTER	Cadaster	
4	OWNER / OPERATOR	Landfill Owner or Operator	
5	X (JTSK)	X coordinate of JTSC	
6	Y (JTSC)	Y coordinate of JTSC	
7	WS_CODE	Waste site code corresponding to REMP2.XLS database (NR)	No - not included in REMP2.XLS database, new site
8	TOP STATUS	Operational Status	Special Conditions / Licensed
9	TILL	License / Special Condition Deadline	
10	CLASS	Construction class according the Order No. 606/92	
11	IMPORTANCE		Local - one or several municipalities, one industrial plant Regional - more than 5 municipalities
12	WASTE_TYPE	General characterization of the incoming waste	IW - Industrial Waste / MW - Municipal Waste
13	H	Hazardous waste	Yes / No
14	O	Other waste	Yes / No
15	S	Special waste	Yes / No
16	REMARK	Remark	
17	W1	Waste categories - item 1	
18	W2	Waste categories - item 2	
19	W3	Waste categories - item 3	

Table 5.4 - 13 Main Operational Incinerators in Study Area

DIS CODE	NAME	CADASTER	OWNER / OPERATOR	IMPORTANCE	WASTE TYPE	REMARK	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	
BR	CKD	Dubova	Petrochema Dubova	Local	HW, SW, OW		11	12	17	18	31	35	39	52	54	55	57	58	59	82	81	
ZH	K-3	Horne Opatovce	ZSNP Ziar nad Hronom	Local	HW, SW, OW		17	18	31	54	55	58										
ZH	SP 303	Ziar nad Hronom	NsP Ziar nad Hronom	Local	HW, SW, OW	Medical waste	93															
BB	BI 050	Banska Bystrica	Nemocnica F.D.Roosvetla	Local	HW, SW, OW	Medical waste	93															

Other possible facilities for waste incineration

DIS CODE	NAME	CADASTER	OWNER / OPERATOR	IMPORTANCE	WASTE TYPE	REMARK	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	
BB			Harmamec papierne																			
BB			Smrecina Banska Bystrica																			
BB			SSC Banska Bystrica																			
ZC			Preglejka Zamovica																			
DT			ZTS Hrinova																			
ZV			SSE Zilina - Teplaren Zvolen																			
ZV			Bucina Zvolen																			
ZV			ZOS Zvolen																			

NR	NAME	EXPLANATION	TERMS
1	DIS CODE	District Code	
2	NAME	Landfill Name	
3	CADASTER	Cadaster	
4	OWNER / OPERATOR	Landfill Owner or Operator	
5	X (JTSK)	X coordinate of JTSK	
6	Y (JTSK)	Y coordinate of JTSK	
7	WS CODE	Waste site code corresponding to REMP2.XLS database (NR)	No - not included in REMP2.XLS database, new site
8	OP STATUS	Operational Status	Special Conditions / Licensed
9	TILL	License / Special Condition Deadline	
10	CLASS	Construction class according to the Order No. 606/92	
11	IMPORTANCE	General characterization of the incoming waste	Local - one or several municipalities, one industrial plant Regional - more than 5 municipalities
12	WASTE_TYPE	Hazardous waste	IW - Industrial Waste / MW - Municipal Waste
13	H	Other waste	Yes / No
14	O	Special waste	Yes / No
15	S	Remark	Yes / No
16	REMARK	Waste categories - item 1	
17	W1	Waste categories - item 2	
18	W2		

3) Composting Facilities

At present, most biological waste is deposited in landfills (or illegally burned on the site). In an attempt to change this situation, the National WMP (Ref 15-1) proposes the following measures:

- create economic instruments to make biological waste composting more advantageous than its disposal;
- finalise the system of regulations and technical standards, assigning the compost quality and application in agricultural and non-agricultural soil.

In 1997 in the Banská Bystrica section of the Study Area, there was only one composting facility in Lukavica (EBA Bratislava), but its main production was oriented to waste. As stated in the Banská Bystrica Regional WMP, this composting site is used mainly for biodegradation of contaminated soil (see "Rehabilitation works on lands contaminated by activities of Soviet Army near Vlkanová and Sliac"). There is no apparent interest to compost biological waste.

There is also a similar facility in Levice district (Transpetrol Bratislava). The WMP of Nitra Region proposes to build up 6 new composting sites before 2000. However, given the existing use and status of composting facilities, such a goal does not seem to be realistic. The impression gained is that composting will remain a treatment method of only limited application, unless considerable investment can be found to encourage its greater use, together with an increase in public awareness about the issue.

(3) Management Issues

1) Cost of Landfill Operations

The operation of old landfills together with several newly built landfills, which are understandably much more costly to construct and operate, has led to anomalies in the pricing of waste disposal. Old landfills charge are somewhere in the region of SKr 300-600 per tonne of waste, whilst the newer sites are having to charge between SKr 600 - 1000 per tonne by comparison. The latter prices are artificially low, relative to the investment costs of constructing new landfill. Gradually, most of operational landfills which meet legislative criteria, are increasing the disposal charges into the range of SKr 800 - 1100 per tonne. Some typical prices for disposal charges at selected regional Class III landfills, are presented below in Table 5.4-14.

Table 5.4 - 14 Typical Disposal Costs for Class III Landfill Operations

Location / District Code	Operator	Household waste disposal charge (year)	Source
Banská Bystrica – Šalková / BB	Ipodec Onyx KROH (French investment)	SKr 1 090 (1999)	Price list
Zvolenská Slatina / ZV	Spoločnosť Pohronie (Danish investment)	SKr 689 (1999)	Price list
Kálna and Hronom / LV	Kálna Kálna nad Hronom	SKr 380	REDISP ⁽¹⁾
Bzenica – Uhlisko / ZH	Bzenex Bzenica	SKr 380	DO-ED ⁽²⁾
Kremnické Bane – Ovcín / ZH	TS mesta Kremnica	SKr 380	DO-ED ⁽²⁾
Principlac Banská Štiavnica/BS	TS mesta Banská Štiavnica	SKr 260	DO-ED ⁽²⁾

Note: (1) Regional Development and Institutional Strengthening Project, Sub-Regional Solid Waste Management Strategy and Investment Plan, draft version, 1999 (GHK International & Know How Fund)

(2) District Office, Environmental Department

Table 5.4-14 shows significant differences in charges between the operators financed from private sector sources in comparison to operators partly, or fully financed by municipalities. In addition to Banská Bystrica and Zvolenská Slatina landfills, there are also those of Sater in Handlová (SKr 750 per tonne) and Ekopolis in Martin (SKr 1 100 per tonne) (Ref. 15-3). The municipal sites are considerably cheaper than the privately funded facilities, due largely to the much greater investment that is required to establish such sites. It can also be presumed that the level of operation and environmental protection at the private sites is considerably better.

There are a number of reasons for the above price differentials, including:

- There are social and political constraints to avoid significant increases in waste charges in several locations, and a concern within the environmental authorities that any such increases will also raise the incidences of fly-tipping ("wild" or uncontrolled waste sites) or other forms of illegal disposal;
- Municipalities are not accumulating any funds with which to invest in future landfill sites, or even to reclaim existing sites. They are dependent on grants from the central government, private sector investors, or other arrangements. Such a situation will not be tenable in the long term;
- Municipalities (often through so called "Technical Service" companies) usually carry out a range of functions (street cleaning, lighting, etc.). In certain municipalities it is clear, that cross subsidisation between the various technical services occurs and no reliable charges can be calculated.

The issue of high disposal costs leading to big increases in fly-tipping, is a major concern and was quoted by a number of municipal authorities. This is already perceived as the single most

significant environmental issue in the Study Area, according to the Environmental Questionnaire (Annex L.1 of the Supporting Report). There does not seem to be any easy way of combating the situation, as disposal costs will inevitably rise in the future, so that uncontrolled disposal may also rise. Major public education and awareness campaigns were quoted as a possible approach, which could also be used to emphasise waste recycling, on both a community and industrial basis. Levying of suitable fines and other control mechanisms may also need to be used, if fly-tipping increases as a result of higher disposal costs.

2) Future Landfill Development

The National WMP (Ref. 15-1) states that at the national level:

"... new, modern, large capacity landfills, with corresponding protection of the surrounding environment against the negative impact of disposed waste, will be built regionally, also because of high investment costs.... Concentrated landfilling will allow better control and monitoring of the impact to the environment. Concentrated landfilling is important because of the lack of proper, available landfill sites."

The WMP of the Slovak Republic (first edition in 1993) preferred a programme involving the development of 48 regional landfills in the whole territory of the Slovak Republic. However, there are 79 Okres in Slovakia, so that under the above proposals, there would only be 1 landfill per 2 districts. More realistically, the alternative within the WMP, which proposed 71 landfills, ie nearly one for each Okres, would appear more effective. Nevertheless, this would still mean that some districts would have to dispose of their waste, outside the district boundaries.

Most of the Okres in the Study Area already have licensed waste disposal sites (Ref. Table 5.4-12). Although the majority of these are licensed beyond the July 2000 deadline for development of compliant facilities, it is not clear if all of them are going to meet all the Class III requirements. Four of the sites have Special Conditions attached to them, suggesting that they will no longer be able to operate. Consequently, new sites may be necessary, requiring considerable investment. Such funds are not likely to be forthcoming from Central Government, so that private developers or funding will have to be sought to assist the municipal authorities in developing new sites.

According to the several sources - mostly private investors - production less than 15 000 tonnes of waste per year is not sufficient to cover operational and other costs eg loans, in operating a

modern landfill facility. Other source (Ref. 15-3) suggests that 25 000 tonnes per year are necessary to attract private investors.

Districts of 45 000 inhabitants and less (Banská Štiavnica, Detva, Zlaté Moravce, Zarnovica – See Table 5.4-15) are unlikely to produce more than 20 000 tonnes of municipal waste per year and may therefore have to rationalise their waste disposal strategies. It may be therefore, that agreements will have to be reached with neighbouring Okres, in order to establish a viable compliant landfill facility.

Table 5.4 - 15 Small Okres Waste Disposal Rates compared to Population

District	Inhabitants (Total) ⁽¹⁾	Inhabitants in urban areas ⁽²⁾	Wastes deposited in landfills within the district area [tonnes] in 1998 ⁽²⁾
Banská Štiavnica	17 000	11 000	5 065
Detva	34 000	24 000	about 20 000
Zlaté Moravce	44 000	16 000	31 626 ⁽³⁾
Zarnovica	28 000	15 000	21 180 ⁽³⁾

Notes: (1) rounded to thousands;

(2) according to questionnaires from the Environmental Departments of District Offices;

(3) more than half of that amount is industrial waste.

In general, municipalities within the Study Area (and the whole Slovakia as well) have based their approach to waste management on the development of small, independent disposal facilities. Several districts within the Study Area therefore appear to have more landfills than they need and maybe can afford to run properly. Some of the landfills do arise from industrial waste, which distorts the picture somewhat. But generally, the waste management systems that have resulted are neither cost effective, nor consistent with the current national policy, which aims to reduce the number of local landfills. That situation will probably lead to the closure of some disposal facilities, operating below the required future prescriptive level.

The REDISP study (Ref. 15-3) has been investigating the possible scenarios that could be employed to meet the needs of Banská Štiavnica, Zarnovica and Ziar nad Hronom, in a joint approach to their longer term waste disposal requirements. A major study referred to has been supported by an economic evaluation exercise (Ref. 15-4), and it is likely that all Okres will have to give similar careful consideration to how future landfill needs are to be assessed, potential sites identified and their development financed.

The use of the GIS based Landfill Suitability Mapping has already been mentioned. It is, however, only a planning tool to aid in the identification of areas within which development of a landfill facility may be feasible. It does not identify specific sites, nor is it a substitute for

other factors that should be considered, namely:

- ground-truth site selection exercises;
- detailed site investigation;
- thorough economic evaluation of waste disposal alternatives;
- preparation of a detailed environmental impact assessment (EIA) of potential sites;
- discussions between waste producers and municipal authorities;
- detailed consultations with potentially affected communities.

All these aspect should be given careful consideration when seeking to develop new landfills, so that the most cost-effective and environmentally sustainable facility is selected, with the maximum of consensus possible.

5.4.3 SOLID WASTE MANAGEMENT – LEGAL AND INSTITUTIONAL ISSUES

(1) Institutional and Legislative Framework

1) Legislation

An institutional and legislative framework for the management of wastes in the Slovak Republic was not established until the early 90's. Up to that time, there was no official definition of 'waste' and all sites containing 'waste' material are still referred to as '*old environmental loads*'. As such, there was no clear responsibility for the management of waste, nor for the collection of waste statistics. With the establishment of waste regulation, following the Waste Act (No 238/1991), a major development took place regarding the control of waste, its production, management and disposal.

The overall framework is somewhat complex, with several layers of administration and regulation and a particularly complicated waste classification system. Having established the basis for waste management in the Slovak Republic, the process would now benefit greatly from some rationalisation, including simplification in approach, especially in waste registration and classification.

The legislative requirements dictate the institutional elements of the waste management, the most significant statute being the Waste Act No 238/1991 and the Act on Waste Management State Administration No. 494/1991. Details for these and other relevant legal requirements,

are provided below.

i) Waste Act No. 238/1991 as amended by Act No. 255/1993

The Act establishes the basic responsibilities and duties of state administration bodies (at various levels) and the duties of legal entities and individuals in relation to waste handling, treatment and disposal. The Act addresses a wide range of issues, including:

- definition of waste (Article 2);
- controls on waste import and export (Article 3);
- responsibilities and duties of state administration bodies (Article 4);
- requirements for waste generators to produce a waste management plan (Article 5);
- duties of waste disposal operators (Article 8);
- establishing the principle of charging for disposal to landfill (Article 10);
- establishing a basis for fines to be imposed for certain infringements (Article 11).

A number of annexes to the Act have been promulgated which seek to provide additional guidance on waste management issues, such as waste minimisation, (reclamation, recycling), and waste import and export from SR.

ii) Act on Waste Management State Administration No. 494/1991 as amended by Act No. 222/1996

The Act identifies roles and functions of each level of the state administration in the field of waste management, as follows:

- The Ministry of the Environment of the Slovak Republic - responsible, *inter alia*, for issuing the national waste management program (WMP), regulating the import and export of waste, and the transport of hazardous waste outside of district boundaries;
- The Environmental Inspectorate - provides supervision of waste management at state level, including the regulation and checking of disposal conditions and site operation, based on reports from the relevant Municipality departments;
- The Regional (Kraj) Office, Environmental Departments - responsible, *inter alia*, for the approval of the transport of hazardous waste outside local boundaries, enforcement of the Waste Act at regional level and issuing the regional WMPs;
- The District (Okres) Office, Environmental Departments - responsible, *inter alia*, for issuing permits for waste facilities, issuing district WMPs, enforcement

of the Waste Act at district level, maintaining waste production records;

- Municipalities - responsible for regulating the management of municipal wastes and commenting on WMPs submitted by waste producers.

In addition, the Statistical Office of the Slovak Republic are responsible for the collation of waste generation data (all categories, viz Special, Hazardous and Other), as part of their overall responsibility for the collection of the general range of data for the whole country. Similarly, the Waste Department (COH) of the SAZP are also responsible for the collection of waste generation data, but restricted to Special and Hazardous waste categories only.

There are numerous differences in the values of the data collected by the two organisations. As can be seen, the regulation and control of waste is a complex issue, and there appears to be no one organisation with full control of waste disposal. This leads to uncertainties with respect to data collection, and may be in part responsible for the major anomalies in the data described in Section 5.4.1 above.

iii) The Act on Waste Deposition Fees No. 309/1992

This Act details charges to be levied for the deposition of waste.

iv) Order No. 605/1992 on Waste Registration

This order sets out the requirements to be met by all waste generators for the recording of waste that they produce, as well as for waste handlers for the recording the waste that they dispose of (transport, dispose, treat, burn or resold).

v) Order No. 606/1992 on Waste Handling

This Order sets out requirements for the handling of waste, including waste storage, treatment, processing, disposal and utilisation.

vi) Decree on Waste Management Programs No. 76/1992

This Decree sets out the specific requirements for the preparation of WMPs by regional and district environmental authorities and by waste generators.

vii) Decree on Establishing of Waste Categories and Issue of the Waste Catalogue No. 19/1992

This Decree sets out details for specification of waste categories and issue of updates of the

waste catalogue.

2) Key Features

In summary, the key features of existing framework for waste management in the Slovak Republic are:

- regulation at state, regional, district and municipal level, with a system of enforcement in place, including fines for infringements of legislation;
- system of waste planning/programming at state, regional, district, municipality and individual waste producer level;
- system of waste classification;
- system controlling and regulating the development and operation of facilities associated with the handling of waste (storage, treatment, processing, utilization and disposal);
- system of charging for the deposition of waste (principally applied to landfilling).

As indicated, there is no one organisation with overall responsibility for the implementation of waste disposal strategies, although the Ministry of Environment has ultimate control over the enabling legislation and its implementation. Nevertheless, there can be wide variation with respect to how effectively the various administrative levels exercise their authority, which in turn leads to a wide variation in the quality of waste disposal.

Available finance is a major factor in how the waste disposal strategies are implemented, and this is likely to remain the case, although there may be some measures that may help redress the situation, countrywide, as well as in the Study Area. These possibilities are discussed in the following section, and relate mainly to the collection, collation and utilisation of waste generation and disposal statistics.

The preparation of a new Waste Act, possibly by the end of 1999, will possibly have an influence on a number of the issues raised within this section of the report. Unfortunately, it has not been possible to obtain details of the new Act, to understand which elements will be changed and hopefully improved upon. There will be a temptation to 'do nothing' until the legislation is in place, but the extent of the issues still to be resolved dictate that delay is not advisable. A number of measures are suggested in Section 5.4.4, which could usefully be implemented in the near future, to aid in the development of an efficient and effective waste management system for the Study Area.

(2) Waste Management Plans

Waste Management Plans are prepared at all government levels within Slovakia, commencing with the National WMP (until 2000) (Ref. 15-1). The Kraj WMPs and the Okres WMPs are developed on the basis of the National WMP, all of which reflect a number of logical policies and objectives, including:

- reduction of quantity of hazardous waste produced;
- expansion of reuse of wastes, including improvements in separated collection of municipal wastes;
- process at least 20% of biological wastes from use as fertiliser;
- during the period of the plan, dispose of 50% of municipal wastes to modern controlled landfills;
- restrict the importation of hazardous waste;
- develop a network of facilities for the treatment of medical wastes;
- continue redeveloping OELs and uncontrolled landfills.

The regional and district WMPs follow the National WMP very closely, providing data on local disposal methods, lists of waste disposal facilities in the respective administrative areas and provide policies, objectives and measures for the implementation of the National policies. However, the plans do not have details of how each objective is to be met, nor do they present much specific details on individual project requirements, including financial issues. They do form the basis for developing future waste management programmes, but suffer from the lack of specific plans.

It would help if such specific information were prepared, as it would then give the WMPs more direction. This would be especially useful for the prioritisation of development proposals and investment requirements.

It would also be beneficial if neighbouring municipalities and Okres interacted in the development of the proposed regional landfills and other waste treatment facilities, as appears to be occurring in the Ziar nad Hronom, Zarnovica and Banská Štiavnica Okres (Ref. 15-3). Due to the investment requirements for the preparation of new, technically acceptable landfill facilities, many Okres and smaller administrative areas will find it beneficial to join forces, due to the scale of costs involved. It is advisable that such arrangements be made at the earliest possible time, building upon the foundations already established through the preparation of the respective WMPs.

(3) Waste Site Monitoring

At the present time, there is a requirement that landfill facility monitoring is undertaken, but there is great variability in the extent to which this is carried out. In some cases, costs are a major problem, whilst in others, there is uncertainty in terms of who is responsible for the sites, especially with OELs. Monitoring therefore tends to be limited to those active sites where owners can be held accountable and responsible for the necessary sampling and analysis. The existing programme needs to be expanded to cover the older sites, which probably represent greater environmental risks than the newly constructed facilities.

To be compliant with the Slovak law (Order No. 606/92), each waste site must have a system for monitoring ground water quality (Article 22). In order to detect any contamination of the underground aquifer by leachate from the landfill, the system must consist of at least two monitoring points (boreholes), one of which is located up-gradient and the other down-gradient, with respect to the ground water flow direction,

The Environmental Department of the relevant District Office determines the sampling frequency and range of analyses. They usually require that professional companies and licensed laboratories perform the sampling and physico-chemical analyses. The frequency is usually 4 times per year, in the case of a Construction Class III landfills. The Department receives the reports from this regular monitoring, but these are not available to the public.

Analysis and interpretation of the collected data is not regularly made, but is available to the SIZP for their records. Where pollution or contamination is suspected, then the results are used to inform the SIZP and also to demand corrective action from the site operators. The result is that suggested control measures are put forward by the Inspectorate, although it is up to the Okres offices to enforce the implementation of the recommendations. SIZP may also undertake random investigations of sites. Under some circumstances, it is understood that academic institutions may be asked to comment or investigate data, where pollution events are suspected (Prof. Húska pers comm).

There are no special limits against which results from groundwater monitoring can be compared. Results are usually evaluated against the limits of "Instruction No. 1617/97-min". These are adopted from the Dutch A, B, C - limits, though the purpose of the "Instruction" is to help evaluate environmental damage in the privatisation process.

According to Order No. 606/92 (§ 22), leachate should be monitored for quality 2-4 times per year, although the quantity is to be recorded once per week. At least temperature, colour, mud content, odour, pH, conductivity, redox potential, chemical oxygen demand, POX (polycyclic organic halogens, eg chlorine) and ammonia are to be measured.

Biogas (landfill gas) monitoring is required, if the deposited waste is likely to produce it. According to the law (Order No. 606/92, Art. 23), biogas quantity and its composition should be checked at least 2 times per year. Again, such monitoring is usually undertaken only on those sites that have been recently established and for which sampling infrastructure is readily available.

5.4.4 WASTE MANAGEMENT ISSUES – RECOMMENDATIONS AND ACTION

(W) General Issues

The absence of legislation to control and manage wastes before 1991, resulted in the proliferation of small scale localised disposal sites throughout the Study Area, with major potential implications for environmental features and public health. The subsequent Governmental control over the issue has led to a much improved, centrally co-ordinated approach to waste management, but which has major implications for the municipally orientated waste handling system that still predominates in Slovakia.

A major feature of the central government approach is for regional landfill disposal facilities (Ref. 15,1), with proper control of environmental performances to ensure protection of the environment. The Study Area suffers from the dilemmas that arise in many part of Slovakia as a result of this policy, since there is a legacy of old environmental loads (OELs) which were the disposal sites that existed prior to 1991 and there is a need to invest in new landfills to meet the new regulations. Although there has been recent development of a number of the new controlled landfill facilities, there are still a number of the older sites, due to be closed by July 2000, unless 'Special Conditions' have been applied to permit their limited future operation.

A large scale investment programme is needed in order to provide sufficient capacity to meet future waste disposal needs. To develop such sites, suitable sources of finance must be identified, it generally being assumed that the private sector will furnish the necessary funds. However, before the private sector can be persuaded to invest large sums in the waste disposal industry, there are a number of issues that need to be addressed. These include:

- obtaining clear, unambiguous statistical data on waste;
- developing a regional or sub-regional plans to rationalise waste management in the Study Area;
- evaluation of the potential for alternative methods of waste disposal and treatment;
- identification of appropriate means of waste transfer, to accommodate the regional landfill strategy;
- prioritisation of the continuing reclamation or rehabilitation of OELs;
- development of a reliable programme for monitoring of all operational landfill sites and selected OELs.

(W1) Waste Statistical Data

W1.1) Waste Classification

Obtaining clear information on the quantity of waste produced is crucial to the successful development of future regional landfill facilities. It is therefore important to resolve the issue of the wide variation in waste statistics, so that there is a suitable, reliable database to help predict how much waste needs to be deposited. At the present time, the variability may arise for a number of possible reasons.

These include the fact that there is an extremely complex system of waste classification, resulting in confusion about registration of wastes by operators and the municipalities. There is also the fact that two organisations presently collect the data, and from different sources. An element of rationalisation is required in these areas, in order to establish the reliable database that is required for effective design and operation of the proposed regional waste disposal sites.

With respect to waste classification, there have been some attempts to modify the situation. For example, agricultural wastes, including, manure and straw, are no longer considered as a waste due to the high percentage of reuse. However the situation needs to be further resolved and further amendments will probably be necessary. This will require modifications to the National Classification system, which is best discussed by SAZP (COH) and SOSR in conjunction with the Ministry of Environment, but municipal authorities and private producers should lobby the competent authorities to effect such changes as soon as possible.

Objective: to rationalise the waste classification system further, in order to simplify completion of the waste statistics forms.

W1.2) Creation of Waste Statistics

Consideration should also be given to the way in which the waste statistics are compiled. At present, the data are derived from the point of waste production, but discussions with municipal authorities and the findings of the REDISP Sub-Regional study (Ref.15-3) indicate that substantial over-reporting occurs as a result. High quantities of waste produced are made use of elsewhere, so in fact never enter the waste disposal stream. The example of agricultural waste given above illustrates the point and there are likely to be others. Associated with this is the fact that waste producers are responsible for providing details of the quantities of waste they generated. Self-reporting is rarely reliable, especially when compounded by the confusing categorisation of waste.

A better system would be to base waste statistics on the amount of waste disposed, rather than produced. It would also place the emphasis on the waste disposal organisations to provide the data for the statistics. This would be more reliable because there would be both a financial record (from charges) plus weigh-bridge information, to use as the basis for assessment. Such an approach will only be feasible in the longer term, since there are many disposal sites without formal recording methods, but provided that the legislative requirements are enforced, then eventually all waste should be disposed of in a controlled and monitored manner. If such an approach was adopted, industrial producers could still be legally required to provide accurate data, even if they were disposing of the waste at their own facility.

In addition to improving the statistical record, it is also considered important to develop an updated version of the GSSR database on old waste sites. A major benefit of this will be to form a framework for the prioritisation of the reclamation or treatment of the remaining waste.

Objective: to develop a waste-disposal based statistical record, removing double-accounting for waste production figures and placing the onus on data collection in the hands of the waste disposal operators.

W1.3) Collation and Publication of Statistics

The present system of data collection leads to a wide variation in the statistical database (See Section 5.4.1). It is possible that this is a result of the way in which the information is initially calculated (as discussed above). However, this would still not explain why some – but not all – of the data recorded by COH SAZP and the Statistical Office of the Slovak Republic (SOSR), are so different. The fact that there are variations in the way the two organisations collect the

data, is likely to be influential in this issue, but will not explain all the differences.

SAZP collects data from Municipal Authorities, but only for Special and Hazardous wastes, through the RISO system (Regional Information System on Special and Hazardous Wastes). As such, the data are considered to be relatively complete, and the figures generally provide a good estimate of the quantity of Special and Hazardous waste, produced for any one municipality. It should also be noted that SAZP reduce to 15% the quantity of slurry wastes, by considering them in dry matter form only. Given that animal slurry constitutes a significant proportion of the waste generated (Ref. Table 5.4.1), there are still going to be a number of data-sets that provide major anomalies, eg in rural areas with seemingly high waste production rates.

The Statistical Office collects information from District Authorities and a network of producers, with returns for Special, Hazardous and Other Wastes being provided. The statistics on 'Other Waste' were first collected in 1995, when a detailed questionnaire was issued to all waste producers, asking them for estimates of the quantity of Other Waste produced. To date, 95-98% of waste producers are reported to provide recurrent data on this waste. These data go some way to providing a complete inventory of the total amount of waste generated, but being at District level, the figures are considered likely to be less accurate.

[The situation is more complicated for the REMP study, since the study boundary does not match exactly the District or Municipality boundaries and therefore some simplification of the data presentation has occurred. As this is applicable to both sets of data, however, it does not explain the variations in the data sets.]

After rationalising the way in which the data are classified, (See 5.4.4 (2)-1) & 2)), the next step is to ensure that SAZP and SOSR amalgamate their methods of statistical collection and collation, thereby standardising their approach and producing more reliable databases. There seems no reason why two organisations should be responsible for the actual collation of the waste data, and it would be preferable if only one authority had the responsibility, under the control of the Ministry of Environment. It is understood that initial discussions have taken place between SAZP and SOSR to attempt to rationalise the data collection and handling (Schwarz, pers comm). It is recommended that such discussions continue with a degree of urgency, so that there will be harmonisation of data collection, primarily to provide a reliable database for national usage.

Given that the main reason for collecting the data is to aid in the planning of waste management in the future, the sooner the confidence limits of the information can be improved, then the more effective the planning will be for the proposed large municipal landfill sites. It will also assist in attaining compliance with European Union requirements of the Landfill of Waste Directive.

Objective: under the control of the Ministry of Environment, for SAZP (COH) and SOSR to rationalise the collection, collation and presentation of waste disposal statistics, with only one organisation taking responsibility for the management of the data, even if another publishes the information.

(W2) Regional and Sub-regional Plans

An element of the major sub-regional planning study, REDISP, (Ref. 15-3), has been to produce a Solid Waste Management Plan for the Okres of Ziar nad Hronom, Banská Štiavnica and Zarnovica. This has identified three alternative strategies, in comparison with the existing situation. The most favoured is the development of a single landfill in Ziar nad Hronom, closure of all other landfills in the three Okres and use of the Ziar facility or export of waste outside the region, dependent upon issues such as transport costs. Such arrangements will require the development of waste transfer facilities, and most of all, a major co-operation between the three administrative authorities.

It is suggested that a similar strategic study be undertaken for the Study Area, either by further sub-regional studies, or possibly for the Study Area as a whole. It is important that the situation is rationalised, given the number of licensed landfills that will be available in the Study Area after July 2000. As a result of the large number of sites that are presently operational, major decisions will have to be made regarding the future make-up of waste management in the Study Area.

It is felt that the recommended studies will build upon the Regional Plan of the Kraj offices, together with the individual Okres Waste Management Plans (WMPs) that already exist. It is considered necessary to develop such a Strategic Plan so that a detailed practical programme can be developed to cover the specific issues of:

- new site requirements;
- rationalisation of waste transport;
- financial provision;

- recycling and reuse of wastes;
- suitable development programmes;
- administrative arrangements.

The Plan will support the general principles that are laid out in the respective WMPs, which in turn reflect the requirements of the National WMP.

It is highly likely that facilities and operations will have to be managed jointly, to achieve cost-effectiveness. However such management agreements should not be entered into without thoroughly studying and understanding the implications of each option or scenario. The REDISP study could be used as a template, since it appears to be based upon consensus management between the relevant Okres, arising from the work of the RDISP study team.

Objective: to develop a clear and quantified understanding of the future waste management requirements for the Study Area, either as a whole or on suitable sub-regional bases.

(W3) Alternative Waste Treatment

At the present time, the majority of waste (52.8%) is landfilled, including industrial production. The majority of the remainder (33.3%) is reused or recycled, eg. agricultural wastes, notably from animal production, used for fertiliser or soil conditioner. Of the remaining quantities, 11.6% is treated, 1.3% stored and only 1% is incinerated. Although the National and Regional policy is to reduce the amount of waste that is landfilled, due to the nature of the geographical, topographical and demographic patterns of the Study Area does not lend itself well to such aims. It does not favour major regional sites, either, due to transport costs and the rural setting of much of the area and the dispersed nature of population.

There are few incentives to pursue alternative method of disposal, when the operational costs of landfill sites remain low. As old, non-compliant facilities are closed or become full and there is a need to operate the purpose designed sites now being developed, then the overall cost of landfilled waste will increase. This may then encourage alternative methods of disposal to be adopted.

A significant proportion of wastes is presently reused in fact, and this does not apply solely to agricultural material. Scrap metal, wood debris and inert material for construction purposes are all presently utilised by industry. However, the effectiveness of recycling of municipal and household waste is questionable, the suggestion being that the initial success of some

municipal waste recycling programmes has waned as a result of reduced government subsidies. For example, containers of various colour for primary separation of waste in residential areas of Banská Bystrica City were removed after 1996, because attempts to recycle municipal waste resulted in financial loss.

Recycling of glass and paper in particular is dependent upon industrialists operating profitably. Import of waste paper, for example from Germany and Austria, sometimes at no-cost to the consumer, is undermining the fledgling industry in Slovakia. Government intervention is taking place with respect to the imported material, but there is still the need for realistic prices to be obtained by private developers, otherwise there will be no incentive to maintain such recycling programmes.

There have been some examples where community based recycling programmes appear to work, eg in the Nitra area (See Section 5.4.2). However, such schemes will only function effectively if there is both municipal authority and community commitment to them. Both sectors will only adopt such schemes wholeheartedly when a profitable basis can be proven, although it might be possible to encourage the general public to be involved with the schemes, through public education and awareness programmes. However, the most effective manner in which to encourage their involvement is to provide some form of benefit or recompense. This could be in cash terms or it may include social benefit, from a community rather than individual basis. Unless a gain/benefit can be demonstrated to all parties concerned, then it is unlikely that such schemes will succeed, without subsidies, which Central Government is not in a position to provide.

Incineration is not much practised, largely due to the improved national emission controls that are being effectively enforced, prior to accession to the European Union. There is a need for a limited number of such facilities for specialist waste disposal, notably for hazardous and medical wastes. High investment costs for new units which can meet stringent emission standards, will probably discourage intensification of use in the future.

As a result of the above, it appears unlikely that a major alternative to landfill will be developed in the Study Area, for the foreseeable future. Improvements in waste recycling and reuse should be pursued, but again is unlikely to succeed unless supported by municipal authorities, at least during start-up periods of specific schemes. Involvement and encouragement of local communities to be involved with their own schemes may improve the situation over time, but will require careful management and support to ensure longer terms viability.

The realistic (increased) pricing of landfill disposal in the region will gradually have an influencing role with regards disposal options, since higher prices will encourage waste producers to minimise waste output. Higher municipal charges may also encourage recycling and reduction in waste production. However such an approach carries a potential political penalty, the implications of which need to be fully appreciated before a commitment can be obtained from municipal authorities.

In trying to reduce the dependence upon landfill disposal of wastes, it is probable that the effects of realistic pricing will have to be experienced before waste reduction and recycling become more widely practised. In the meantime, encouraging public awareness of recycling schemes and the longer term community and environmental benefits, should be effected through a series of media and educational campaigns.

Objective: to improve public awareness with respect to waste recycling and improve industries adoption of waste minimisation, through educational programmes and realistic pricing mechanisms for waste disposal.

(W4) Medical Incinerator Operation

The new medical incinerator at Roosevelt Hospital, Banská Bystrica, was visited in May 1999. It is understood that acceptance trials were awaited, having been delayed due to bureaucratic formalities. In other respects the facility was ready to become operational. It is also understood that once commissioned, the incinerator will handle medical waste for the whole Kraj. It is understood that the facility was due to commence operations in September 1999, but this was not the case at the time of report preparation.

The condition of the small incinerator operating at the hospital prior to this, could only be described as atrocious. This term was applicable to all aspects, including waste storage and handling, combustion efficiency, emission quality and worker health and safety. It is sincerely hoped that the facility will be closed as soon as possible, following commissioning of the new facility. If it has not, then this must be effected without delay. Other medical disposal facilities were not visited in the Study Area, but if their performance is similar to that of the Banská Bystrica unit, then all environmental authorities are right to express concerns about their operation. It is unknown when the facility will become operational.

Due to the dispersed nature of sources of medical wastes requiring incineration, it is possible that a second new facility may be required for the Study Area, in spite of the high investment