ENVIRONMENTALLY SOUND MANAGEMENT OF SOLID WASTE

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Introduction

This chapter discusses most sources of solid waste: household waste, municipal solid waste, commercial and industrial waste, agricultural and hazardous waste, and examines the degree to which Israel has progressed in the area of solid waste management from 1992 till the present. To an extent, it also considers plans for the future. While this document includes a critique of the Ministry of the Environment's activity, the major source of data and analysis on the subject is the ministry's Solid Waste Division.

Summary

According to figures from the Ministry of the Environment and the Central Bureau of Statistics, Israel produces 4,818,000 tons of municipal solid waste (in 1998). This includes domestic waste, yard trimmings, and commercial and industrial waste (excluding construction waste). In addition, Israel produces 2 to 6 million tons of construction waste, 300,000 tons of agricultural waste (not including biodegradable organic waste), 3 million tons of animal excrement, 1 million tons of produce which is destroyed, 500,000 tons of wastewater sludge, 500,000 tons of contaminated soil, and more than 200,000 tons of hazardous waste.

The yearly rate of increase of solid waste in Israel is 5%, while the growth rate of the population is only 2% a year (Toward Sustainable Development 1998). For example, in 1998, each resident produced 2.2 kg of waste, representing an increase of 83% from the 1.2 kg of waste produced in 1972.

Solid waste management in Israel underwent a radical change during the 1990s after the closure of scores of unlined garbage dumps. By the end of the 1990s, several regulated landfills designed for collection and treatment

of leachate and biogas were in operation. Despite the apparent progress, solid waste management in Israel is in crisis, and lacks sufficiently advanced, environmentally sound planning solutions for both the short and long terms.

Local government authorities are responsible for treatment of solid waste in Israel, whereas the role of the Ministry of the Environment is in formulating policy and enforcing the laws relating to waste management. Over the last decade the ministry has failed to draw up a detailed master plan with policy guidelines, targets, budgets and methods of waste treatment. In the absence of such a plan, any attempts at creating the appropriate infrastructure for phasing in advanced waste management solutions meets with serious difficulties. Given this state of affairs, local authorities ultimately dictate waste management policy, more often than not seeking the cheapest solutions, and, lacking adequate guidelines and assistance, turning to landfill disposal, including unregulated dumps, as a solution.

According to the Ministry of the Environment's most recent data, 14% of municipal waste (by weight) is recycled, and the rest is sent to landfills. 35% of municipal waste is transferred to unlined waste dumps, without any facilities for collection and treatment of leachate and biogas. In 1993 the Collection and Transfer of Waste for Recycling Law was passed; regulations adopted in 1998 required local authorities to meet recycling targets of 10% by 2000, 15% by 2001, and 25% by 2007. Despite the modesty of these targets relative to European or North American standards, nearly all local authorities evade this requirement. The reasons for this are the extremely low costs of landfilling, minimal enforcement, and a lack of infrastructure. Environmentally sound alternatives to landfill disposal have not developed in Israel, with the exception of three Material Recovery Facilities (MRF), the recycling of approximately 30% of paper and cardboard, and a few compost facilities for trimmings and organic agricultural wastes.

International commitments

The **UN Framework Convention on Climate Change (1992)** defines Israel as a developing country, obligated merely to inventory sources of greenhouse gas emissions within its territory, with a general commitment to prevention of climate change. Agenda 21 sets forth a number of solid waste–related objectives:

Reduction of waste, including the creation of a mechanism for monitoring changes in the amounts and composition of the waste. Developing countries were expected to stabilize waste generation without curtailing economing growth by the year 2000. All countries are required to draw up plans for reduction of agrochemical waste and hazardous packaging materials.

Maximum reuse and recycling, while exploiting technologies with a reduced environmental impact. Public awareness campaigns and public participation are integral to this activity, as well as the indentification and development of markets for recovered materials.

Promotion of environmentally sound techniques for the disposal and treatment of waste.

Expansion of existing collection and disposal systems that meet minimal sanitation requirements, to prevent the outbreak of epidemics and environmental damage among all population sectors.

The ongoing dominance of landfill disposal in Israel

Waste management in Israel operates according to the National Outline Plan for Waste Disposal, drawn up in 1973–1974. At that time, landfilling was regarded as the only option for waste disposal. Although the plan has since been updated with new landfill sites added, a new detailed plan has not been drawn up answering to current needs and based on contemporary knowledge about advanced technologies appropriate to Israel.

During the past decade Israel has relied on landfills as a central solution for solid waste management. The Ministry of the Environment's data reveals that the amount of waste not designated for landfill disposal has risen by 10% over the last decade (from 3% to 14%), and if pre–consumer recycling is counted, the rate of recycling reaches 20%. The rest of the waste goes to landfills, with 35% of the landfilled waste still ending up in unlined dumps.

Over the past decade the Ministry of the Environment has made a concerted effort to close down most of the illegal waste dumps, and has concentrated landfilling in a limited number of sites. Currently 10 central landfills are in operation, as well as 3 material recovery facilities and several local landfills in the Negev. The landfills currently in operation include unlined waste dumps, lacking in infrastructure for the collection and treatment of leachate and biogas, where waste is merely buried and covered by earth. This method still accounts for around 35% of all waste. Almost 20% of waste buried in

this manner is located in areas of high hydrological sensitivity, at a time when Israel is suffering a severe water crisis.

The Ministry of the Environment and the Ministry of the Interior declared that they would shut down three of the five remaining illegal landfills by the end of 2001. In fact, only one, which received 1,000 of the 5,000 tons transported daily to illegal landfills, was shut down according to schedule. Again, the local authorities' failure to comply with the law is at the root of the problem. This failure is serious, since most of the waste could have been disposed of by now at modern landfills, thus reducing environmental damage. To facilitate the transition to modern landfill disposal, the Ministry of the Environment has subsidized the difference in price between modern landfill disposal and disposing of solid waste in unlined dumps, reducing the subsidy by 20% per year over a five–year period.

State subsidization of landfill disposal

In Israel, landfills enjoy state subsidies, because no payments are required for the land they use, or for the future limitations on land use many decades after their closure. Many landfills operate without a license, or abuse their license by expanding beyond their limits to accommodate larger quantities of waste. At older landfills, operators in some instances have upgraded sections or "cells," leaving older cells without infrastructure for reducing pollution.

Landfill operators are presently not required to obtain insurance against short– and long–term environmental risks associated with landfill operation. Landfills continue to pose a severe environmental threat for decades after they are shut down, but no guidelines exist for local authorities as to the appropriate procedures for future treatment and monitoring of sites post–closure. New landfills are most likely to be opened in the southern part of the country, where because of the arid conditions, organic matter decomposes slowly. As a result, these landfills present an environmental threat over a longer period of time, requiring monitoring and treatment for many decades. It goes without saying that few local authorities wish to take on such extended responsibility. Clearly, part of the reason that landfills in Israel are so inexpensive is that long–term consequences are not taken into account.

Changing market conditions

To enable diversion of waste from landfills to more environmentally sound solutions, such as reduction, re–use, and recycling, the latter must become economically competitive. Landfill disposal in Israel is very inexpensive, costing between $8–$12.50 per ton (exclusive of transport).

Since environmental externalities are not internalized, prices are distorted, creating incentives for harmful practices. The Ministry of the Environment has attempted—to date unsuccessfully—to correct this market failure by promoting a fee, which internalizes some of the external costs of landfilling (pollution of air, soil, water, health costs, land use, and others). These parameters do not include constraints on future land use, or the economic costs of long–term environmental risks (estimated at $5–$10 per ton of landfill waste). Integrating these parameters will improve the economic logic of the landfill fee, whose primary purpose is to establish a clear policy for shifting the solid waste burden from landfills to more environmentally sound technologies.

The European Union has taken an unequivocal position, declaring via EU Directive that landfill disposal is an environmentally destructive technology, and establishing that the amount of organic waste going to landfills should be gradually reduced by 75%. While Israel's Environment Ministry has set as its goal the reduction of landfill disposal by 50% by the year 2010, it has declared landfill disposal to be environmentally equivalent to recycling, composting, incineration and anaerobic treatment of solid waste.

Greenhouse gas emissions from landfills

An examination of greenhouse gas sources carried out in 1996 predicted that Israel's landfills will produce 27% of all greenhouse gas emissions generated in Israel over the coming 20 years. Over the next century, these landfills will account for 13% of all greenhouse gas emissions. Landfills rank second only to fossil fuel–burning power plants as a source of greenhouse gas emissions in Israel.

Sector	CO_2 (10^3t/y)	CH_4 (10^3 t/y)	CO_2 equivalent (10^3 t/y)	
			20 years	100 years
Energy	**51,600**		**51,600**	**51,600**
Cement production	**1,700**		**1,700**	**1,700**

Forestry	**– 400**		**– 400**	**– 400**
Agricultural		**42**	**2,400**	**900**
Solid waste disposal		**370**	**20,700**	**7,800**
Wastewater treatment		**10**	**600**	**200**
Total			**76,600**	**61,800**

Table 1. Summary of emissions and removals of carbon dioxide (CO2) and methane (CH4) from different sectors (1996 figures).
Source: Government of Israel: Center for Nuclear Research, Report #2784.

Over the past three years, several landfills, which receive 65% of municipal and other types of solid waste, were established or upgraded to collect and treat biogas and leachate. Current sources of greenhouse gas emissions are: closed dumps or abandoned un–rehabilitated cells within operating landfills, modern landfills (where 30% of the gas is not retained in the collection facility), new cells lacking infrastructure for biogas treatment, and active dumps with no infrastructure.

Israel continues to rely on landfilling, and does little to reduce greenhouse gas emissions, apart from changing over to new landfills with biogas treatment facilities. There has been no systematic effort to reduce the amount of organic matter going to landfills, which is the main source of methane and CO_2 emissions. In addition, no national detailed plan or budgetary framework exists to address the problems of data collection and rehabilitation of large abandoned dumps.

Additional air pollutants from landfills

Abandoned unrehabilitated dumps are a significant potential hazard because, in the past, they accepted various types of waste including hazardous waste and medical waste. Most of the abandoned sites are not monitored, and the rates of their emissions to air, ground and water of various pollutants, including organic and inorganic materials and heavy metals, are unknown. Several of the sites experience internal burning but no survey has been conducted to show which sites are burning or to what extent, despite the resulting severe emissions of air pollution. This problem becomes graver yet, as communities expand or new ones are built in proximity to abandoned or unrehabilitated waste sites, in towns such as Shoham, Rishon Le–Tzion and Haifa. Responsibility for rehabilitating the

sites lies with the landowner—usually the local government authority. Local government in Israel is generally hard–pressed for finances, and finds it difficult to raise the funds necessary for the task. The consequence is a heightened risk of air and water pollution from scores of large abandoned waste sites.

Landfill disposal beyond the Green Line

The treatment of solid waste beyond the Green Line is highly problematic: 342 large dumps lacking any infrastructure are in use and waste burning and spontaneous fires are a common occurrence at these dumps. In some Palestinian villages no collection system exists, and residents bury or burn waste in their yards, or at a small site outlying the community. Many of these sites are located in hydrologically sensitive areas threatening water resources of both the Palestinian Authority and the State of Israel. There is also transit of bulk waste and construction waste, as well as varying amounts of municipal waste, from Israel into Palestinian territories. Despite the severe pollution of drinking water, air and soil, and the health risks for residents in these areas, the dumps continue to expand.

Waste reduction and recycling: modest beginnings

In Israel, the only currently practiced alternatives to landfill disposal of solid waste are recycling and composting, which account for approximately 14% of all waste. Recycling is carried out at three waste recovery facilities, which deal with compost, yard trimmings, and separation of cardboard, plastic, and metal. These facilities recycle around 30–40% of the waste they receive. 25% of cellulose used at factories for cellulose products is collected and recycled. A small percentage of plastic and glass is recycled as well, with several municipalities now practicing source separation of PET, cardboard, paper and rags. One plant for recycling scrap metal operates in Israel. This plant also receives tin cans collected in accordance with the Beverage Container Deposit Law.

The fact that the increase in solid waste generation in Israel is twice the rate of population growth indicates a constant growth in consumption (Avnimelech 1999). This also indicates that no significant reduction or stabilization of waste production has occurred. The Ministry of the Environment's data from 1999 (Vital Signs 2000) show that the amount of waste produced in communities with a high socio–economic profile is liable in some cases to be 51 times greater than the amount produced in communities located at the bottom of the socio–economic ladder. Unless

efforts are made to reduce waste, the reduction of socio–economic gaps as a result of a rise in the standard of living will bring about a rapid increase in the amount of per capita waste produced. Changing production and consumption patterns is an area where both the Ministry of the Environment and NGOs are active through legislation, education, database development, and initiating pilot projects.

Building public awareness

Public opinion is one of the most important vehicles for implementation of environmental policy. To create public pressure, it is necessary to raise awareness and increase public participation in environmental affairs. Waste management, waste reduction and recycling are areas where the public's role is obvious, extending beyond awareness–building to lifestyle changes.

Education for behavioral change has not taken on the necessary momentum. The activity is limited to schools and pre–schools as part of local initiatives. A few local authorities have integrated education on the subject of waste management into school curricula. The only education center dedicated to the issue, with support from the Ministry of the Environment, is located in the Western Galilee at the Material Recovery Facility "Compost 2000", where about 1,000 students per year participate in educational programs.

Legislation

Changes in consumption patterns can be encouraged through legislation. Israel has passed a Beverage Container Deposit Law, which affords the public a role in recycling. The Ministry of the Environment is promoting a packaging law, which will allow the public to return packages for recycling. Similarly, local authorities are bound by the Collection and Transfer of Waste for Recycling Law, which potentially could become an excellent catalyst for public involvement in changing consumption patterns.

The **Beverage Container Deposit Law,** which went into effect on October 1, 2001, is the first environmental law to require minimization of the waste reaching landfills, based on the principle of EPR (Extended Producer Responsibility). The passage of this law is a tribute to the effectiveness of cooperation between legislators and NGOs in promoting environmental legislation while facing the opposition of producers, importers, distributors, and even the Ministry of the Environment. The Ministry believed initially that priority should be given to promoting a Packaging Law and therefore

refrained from supporting the Deposit Law. After eight years of travail in the legislature, and before the bill's approval in August 2000, the Ministry set aside its earlier opposition and advocated its passage.

In 1994, the Ministry of the Environment began to promote **legislation to reduce packaging**. This initiative is the focus of a committee composed of different parties: government, NGOs, and commercial and industrial interests. At present, commercial and industrial interests are managing to delay any progress on legislation.

In 1993, the **Collection and Transfer of Waste for Recycling Law** was passed, and regulations were adopted in 1998 requiring the local authorities to recycle waste, with targets placed at 10% in 2000, 15% in 2001, and 25% by 2007. Local authorities are responsible for implementing the law, and for encouraging the public to play a role by engaging in source separation of household waste. In fact, the local authorities overwhelmingly ignore the requirements of the law. As the Environment Ministry has not enforced the law, targets are seldom met. In 1999, the Israel Union for Environmental Defense, a non–governmental environmental advocacy group, petitioned the Supreme Court, demanding that local authorities fulfil their reporting obligation and that the ministry use its powers to enforce the law. The petition led to commitments by the Center for Local Government and the Ministry to fulfil their obligations.

Database development

A 1995 survey examined in detail the composition and quantities of municipal solid waste, with secondary attention paid to industrial waste. Other data sources are the annual reports of the local authorities regarding the amount of waste consigned for recycling, in compliance with the Collection and Transfer of Waste for Recycling regulations (1998).

The deficiencies of these information sources compel the Central Bureau of Statistics to estimate quantities of waste for many local authorities. A continuously updated database is an absolute requirement, and serves as a constant reminder for local authorities to examine their practices and seek better solutions. Reporting regulations for recycling must be updated to require data on the type and quantities of various types of waste designated for different methods of treatment by each local authority.

Municipal collection of household–separated waste

Several pilot projects have been carried out in Israel by the Ministry of the Environment and local government authorities to test the feasibility of involving the public in waste management through household–based source separation. The experiments were carried out in 1972, and later in 1994 and 1998 in towns ranging in size from 10,000 to around 25,000. In general, these efforts have failed, with the exception of the town of Tivon, in the north. Analysis of these projects reveals that the failure does not lie in the unwillingness of residents to change their behavior. On the contrary, the public proved to be enthusiastic and adaptable, and readily performed its part.

The weak link in the public participation scheme was the lack of reliable end–use solutions, and the resistance of local authorities to implementing the necessary long–term changes. Sometimes the failure stemmed from the central government's lack of financial and professional support. NGOs and academic bodies play an important role in these initiatives, and the Ministry of the Environment provides funding and advice. Despite the Ministry's efforts over past two years in encouraging local authorities to examine recycling alternatives, and even where local authorities could save money by doing so, local decision–makers have generally not cooperated or fulfilled the requirements of the Recycling Law, and continue to display distrust in the public willingness for change.

The Ministry of the Environment has not filled the void created by the local authorities' failure, and has not promoted cost–effective end–use solutions. The Ministry was involved in establishing only one material recovery facility over the past decade (in 1996). Since the public perceives the Ministry as a protector of its interest, the Ministry could take advantage of its image by promoting more projects. This necessitates allocation of budgetary resources and personnel to promoting public participation in source separation. An informed and involved public will strengthen the Ministry's position vis–à–vis other governmental ministries, and will improve the status of environmental protection as one of the more significant governmental goals.

Material recovery facilities

The cost of landfilling mixed waste in Israel is about $8–12.5 per ton, constituting between 2% to 12% of the general cost of treatment (collection, transportation, treatment), which runs between $62–112 per ton. Material recovery currently costs about $20–25 per ton. Under these circumstances it

is no surprise that local authorities should prefer landfilling, unless they are required to pay the additional costs of long distance transport, including the costs of handling waste at transfer stations.

Given the cost of treating waste at material recovery facilities in Israel, and in light of the fact that the local authorities are not interested in engaging the public in waste management, the most feasible solution is transporting mixed waste to a material recovery facility (MRF), without source separation. Despite the fact that MRFs are the only viable alternative to landfilling, in terms of price, they have yet to enter into widespread use in Israel.

In 1999, Haifa, the third largest city in Israel (with 267,000 residents in 1998), made a contract with the Amnir Onyx Co., which operates an MRF in the town of Afula. Through this arrangement, Haifa has become the first major Israeli municipality to comply with the law by recycling 15% of its waste. Events leading up to this arrangement included the closure of an illegal waste site in the city by the Ministry of the Environment, and a lawsuit by the Israel Union for Environmental Defense that forced the Municipality to include recycling in the tender for transfer and treatment of its waste. Haifa's efforts are unique among large cities, however, and will remain so as long as waste management is not given priority at the national level, with the necessary policies and enforcement measures.

Use of household composters

Biodegradable organic waste constitutes about 50% of domestic waste by weight. Separation of organic material within the home can therefore significantly reduce the amount of organic waste reaching landfills. Domestic compostors are one method of treating organic waste at the source. This solution is eminently suitable for residents in rural communities and single unit residences.

In 2000, only 2,600 domestic compostors were in use, amounting roughly to 1% of the potentially suitable households. Every family using a compostor can reduce the amount of waste collected by 0.5 to 1 ton yearly. At present, projects encouraging composting are the result of joint efforts of the Ministry of the Environment, local authorities, and NGOs. The Ministry funds 50% of the purchase cost of a compostor, which runs currently at $87–$100 . Even with this subsidy, the cost is high, and purchasers are usually environmental enthusiasts, and not the public at large. Domestic composting can save local authorities the $45–$50 per–ton cost of solid waste collection and disposal, leaving only the one–time investment in a compostor. Despite this

advantage and the feasibility at both the local and national level, the rate of composting is marginal.

Other potential applications of recyclable organic waste

Highly separable organic waste is produced in civilian and military dining halls, in markets, in municipal and domestic parks and gardens, and by agricultural activity. Treating organic waste at a high level of separability would allow exploitation of the organic material for high–quality compost which is valued at $30 a ton, at the compost facility's entrance. The cost of producing compost in Israel has been evaluated at $8–$12 per ton. The price of compost from municipal waste is between $0–$5 per ton, at the facilities' entrance.

The potential of food and market waste has not been exploited, nor has slaughterhouse waste been exploited for production of food for animals. The Israel Defense Forces, with the cooperation of the Ministry of the Environment and local authorities, is examining a scheme for source separation of waste from military dining halls.

According to Ministry estimates, the agricultural sector produces yearly 3 million tons of animal excrement, 1 million tons of produce which is destroyed, and 20,000 tons of plastic sheets. Despite Israel's advanced agricultural sector, this waste is not effectively recycled. Some preliminary experiments have been conducted locally, but no program has been implemented. As most local authorities lack a system for collection of organic agricultural waste, it is generally burned by farmers, along with plastic sheets and chemical fertilizer and pesticide containers, causing severe air pollution. Despite its economic value as a source of high–quality compost, most of the excrement is conveyed via channels to open spaces and riverbeds. Agricultural demand for such compost could provide the key for effective use of this waste as organic fertilizer.

Wastewater sludge from sewage treatment facilities is another source of organic waste, reaching 500,000 tons a year. This waste can be used as source of energy through anaerobic digestion or as a basis for high–quality compost, when combined with an organic bulky agent. Yet this resource is seldom exploited in Israel. Sewage sludge from the Tel–Aviv metropolitan area, for example, is discharged via marine pipeline into the Mediterranean Sea, rather than being diverted for agricultural uses or energy production. One of the reasons is that municipal treatment systems are generally unable to prevent the entrance of industrial wastewater, which contains high

percentages of heavy metals and renders the sludge unusable. Enforcement and documentation of these sources of pollution will allow improvement of wastewater sludge quality, in turn enhancing its suitability for reuse.

Other waste management technologies and practices

Beyond the ongoing struggles between subsidized landfill disposal and recent efforts to introduce recycling/reuse policies and practices, other significant features of solid waste management in Israel merit attention. The first is the emerging interest in incineration, backed by the Ministry of the Environment as well as private–sector investors. The inadequate treatment of hazardous waste and the widespread neglect of construction debris are other important issues. A final area of concern is the wholly inadequate treatment of solid waste beyond the Green Line, exacerbated by the transfer of various forms of waste from Israel into these areas.

Incineration of municipal solid waste

In the absence of a comprehensive, updated master plan for solid waste management, which includes specific targets and schedules, the Ministry of the Environment has been sidetracked by initiatives and projects that may pose serious environmental risks. A clear example is the proposed construction of a large–scale solid waste incinerator in the Haifa metropolitan area. This area already suffers from poor air quality, which can explain the high reported levels of disease and mortality from cancer, cardiovascular and circulatory disease, as compared with other large cities, such as Jerusalem and Tel–Aviv. Installation of an incinerator is liable to aggravate the pollution.

The Ministry of the Environment has offered to promote the Haifa area incinerator by subsidizing the difference between the expected cost of incineration and the lower cost–per–ton of current waste management programs. In a region of the country where recycling has begun to take hold via two material recovery facilities and a number of local recycling programs, the Ministry's subsidy is likely to divert substantial quantities of waste away from recycling.

Worldwide, incineration costs around $70 per ton, and in Israel too the costs are expected to be high in comparison with MRF recycling, whose cost is in the range of $20–25 per ton (not including source separation). The Ministry claims that incineration is a legitimate option for Haifa despite the fact that no alternatives were examined, such as recycling, anaerobic

digestion, and others. Neither the Ministry nor the Haifa Municipality has examined with sufficient thoroughness the increased air pollution that the proposed incinerator can be expected to produce.

Among professionals, incineration is viewed as a controversial technology, with regulations made more stringent periodically. The faulty operation of the hazardous waste incinerator in Israel, which was closed down for a month in 2001 at the request of the Ministry of the Environment, is proof of the grave dangers accompanying incineration, especially when it is done at low cost without appropriate infrastructure for monitoring and analyzing on location. Experience gained worldwide indicates that the best infrastructure for combined treatment of waste relies on a broad base of recycling, and not on replacing recycling technologies with incineration.

Management of hazardous waste

Industry, commerce and agriculture represent the main sources of hazardous and toxic waste, amounting to more than 200,000 tons of waste per year. Most hazardous waste is treated in a proper manner, but a small unknown portion of hazardous waste is dumped illegally along roadsides or is transported to conventional landfills which are not equipped to handle this kind of waste.

Currently only one hazardous waste site operates in Israel, in the Ramat Hovav Industrial Zone, in the southern part of the country. The site contains large amounts of waste discarded there from the time of the site's installation. Much of this waste is still unidentified, and is being treated by subcontractors, whose work is not always highly professional.

Comprehensive treatment of toxic waste is usually not integral to production processes in factories, and responsibility is transferred to the hazardous waste site. This arrangement is convenient for the factories, but creates serious hazards because of the transportation and concentration of these materials at a central site.

The official excuse for the faulty treatment of hazardous waste is that authority is dispersed among various government ministries. The transportation of hazardous materials, for example, is the domain of the Ministry of Transport rather than the Ministry of the Environment. As a result, the risks involved in the transport of hazardous materials devolves upon a government ministry with little expertise in the field of environmental protection.

Household toxic waste is not treated as hazardous waste, and is disposed of in conventional landfills, causing serious hazards. According to Environmental Services Company Ltd. (which operates the Ramat Hovav hazardous waste treatment plant), approximately 5 kg of household hazardous waste per capita is generated each year.

The Ministry of the Environment and the local authorities have nominally cooperated on a project for collection and transport of batteries to a hazardous waste site. This project has made only painstaking progress, however, in part because of the local authorities' reluctance to collect the batteries at commercial centers and schools. The Ministry, in turn, has been lax in promoting the project over time.

Construction waste

According to estimates of the Ministry of the Environment, Israel produces annually 350 to 1,000 kilograms of construction waste per capita, or some 2 to 6 million tons every year. Roughly 50% of this waste is discarded along roadsides, on open spaces, and in illegal landfills. Over the years, vast amounts of construction waste have accumulated near most population centers.

Construction waste is cleared away by private contractors, many of whom are unlicensed and unsupervised. Many of them also engage in the theft of sand and topsoil, filling in the illegally gouged holes with construction waste that has been collected for a fee at construction and demolition sites.

Lack of enforcement on the part of central and local government is responsible for this predicament. The central government sets conditions for the licensing of landfills, but pays scant attention to the problem of collection and removal of construction waste, where the problem actually begins. In general, local authorities belittle the importance of supervising disposal of construction waste despite their obligation to do so, expending most of their energy on supervising construction processes.

The central government must develop a detailed national plan for solving the problem, first by outlining the desired division of labor between the central and local government in relation to supervision and enforcement, and second, by requiring all contractors who deal with construction waste to obtain a license. Another approach would be to adopt a solution modeled after the municipal solid waste management system, where disposal is carried out by a limited number of subcontractors who would be approved by the Ministry of the Environment, and work in coordination with the local

authority. It should be noted that despite the clear advantages of recycling construction waste, and the almost identical costs of recovery of aggregates as compared to landfilling them, hardly any recycling activity exists. One of the factors inhibiting use of recycled aggregates is the lack of regulation or guidelines governing the use of recycled materials for infrastructure and construction.

Summary

- 13% of greenhouse gas emissions in Israel come from solid waste landfill sites (1996 data).

- The State of Israel manages its waste based on National Outline Plan #16, dating from 1973–74. An updated master plan is needed as a step toward reduced landfill dependence, and a transfer to environmentally friendly technologies.

- Databases in Israel for the composition and quantities of waste are deficient, because local authorities are the primary information source. A periodic national survey of waste should be conducted, and enforcement of the local authorities' regular reporting requirements is necessary.

- Israel continues to rely on landfills as the primary means of solid waste treatment and disposal. The low cost of landfill disposal ($8–$12.5 per ton) prevents the adoption of any truly environmentally sound alternative technologies. Decision–makers must re–examine their conventional cost–benefit analyses of solid waste management options, revising their calculations to include the economic externalities of landfill disposal. These considerations should lead to elimination of present subsidies for landfilling in the form of free land–use and the absence of liability for long–term environmental damage.

- The central government displays a clear preference for consensual solutions, but as a result of its placatory policy, 35% of landfilled waste reaches unlined waste dumps.

- Despite the existence of legislation requiring local authorities to divert 15% of their waste to recycling at present and 25% by 2007, most local authorities do not comply with the law as the result of insufficient enforcement on the part of the Ministry of the Environment. In order to achieve integrated solid waste management, a concerted enforcement

campaign is required. Local authorities must be made to comply with the Collection and Disposal for Recycling Law.

- Local authorities display ongoing distrust in the public's willingness or capacity to participate in waste management through source separation, despite the fact that pilot projects have successfully demonstrated the public's readiness to participate.

- The only law directly involving the public in advanced waste management is the Beverage Container Deposit Law, which took effect in 2001. The law has received public support, but is suffering setbacks due to resistance of producers and distributors of beverage containers.

- Educational initiatives geared toward lifestyle changes have been minimal, dependent largely on local government and NGO initiatives with little leadership shown by the Ministry of the Environment.

- Despite the fact that the composition of solid waste in Israel contains a high degree of organic material (around 50% by weight), the country has not taken advantage of composting as a viable alternative, either by creating central installations, or through encouraging domestic composting. Sources of organic waste should be matched with the high demand for quality compost in agricultural areas. This is particularly true for the southern part of the country, whose highly developed agriculture is based on poorly aerated soils, a deficiency that can be readily corrected by the addition of compost.

- The suitability of incineration to Israel as a means of managing various solid waste streams must be critically evaluated, before it is implemented as an alternative to waste reuse, recycling, and landfill disposal.

- Currently only one hazardous waste site operates in Israel, in the Ramat Hovav Industrial Zone, in the southern part of the country. The site contains large amounts of waste discarded there from the time of the site's installation. Much of this waste is still unidentified, and is being treated by subcontractors, whose work is not always highly professional. Household toxic waste is not treated as hazardous waste, and is disposed of in conventional landfills, causing serious hazards.

- Since Israel has no program for separating and treating hazardous household waste, much household hazardous waste arrives at conventional solid waste landfills in mixed form. Unregulated landfills, as

a result, have become sources of severe pollution, and even regulated sites will become hazardous once their biogas and leachate drainage systems collapse years after the landfills close. The problem needs to be recognized, and legislation is required to assure proper collection and treatment of household hazardous waste.

- The manner in which construction waste is treated in Israel is a national scourge. According to Environment Ministry estimates, 50% of construction waste is discarded on roadsides and in open spaces. The situation requires tough measures by local and central government bodies, including a reduction of the number of companies licensed to deal with this waste, so that their activity can be supervised.

- Undocumented quantities of waste travel beyond the Green Line to illegal waste sites, where waste is disposed of in unlined dumps or is treated by open burning. The transport of waste beyond the Green Line should be prevented by enforcement action against the relevant governmental and private bodies responsible for this environmentally damaging practice.

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