

Annex 9

*Preliminary Design of Cimsa Site
Development*

Contents

| | Page : |
|---|-------------|
| 9 Preliminary Design of Cimsa Site Development | A9-1 |
| 9.1 Outline of the Priority Projects | A9-1 |
| 9.1.1 Selection of the Priority Projects | A9-1 |
| 9.1.2 CIMSA Site Development | A9-2 |
| 9.2 Design of Separate Collection System..... | A9-4 |
| 9.2.1 Examination of Technical Alternatives | A9-4 |
| 9.2.2 Preliminary design | A9-4 |
| 9.3 Design of the Sorting Plant..... | A9-5 |
| 9.3.1 Basis for Preliminary Design | A9-5 |
| 9.3.2 Preliminary Design | A9-9 |
| 9.4 Design of a Compost Plant | A9-17 |
| 9.4.1 Examination of Technical Alternative | A9-17 |
| 9.4.2 Preliminary Design | A9-24 |
| 9.5 Design of a Final Disposal Site..... | A9-36 |
| 9.5.1 Examination of Technical Alternatives | A9-36 |
| 9.5.2 Preliminary design | A9-39 |
| 9.6 Design of a Medical Waste Disposal Site..... | A9-57 |
| 9.7 Rehabilitation Plan of Present Landfill..... | A9-67 |
| 9.7.1 Existing condition of Present Landfill | A9-67 |
| 9.7.2 Rehabilitation Plan of Present Landfill..... | A9-69 |
| 9.8 Cost Estimation..... | A9-71 |
| 9.8.1 Conditions of the Cost Estimate | A9-71 |
| 9.8.2 Investment..... | A9-72 |
| 9.8.3 Operation and Maintenance Costs | A9-80 |

List of Tables

| | Page : |
|---|--------|
| Table 9-1: The Targets of the Priority Projects for Mersin GM | A9-1 |
| Table 9-2: Waste Generation, Discharge and Collection Amount in MGM | A9-4 |
| Table 9-3: Productivity of Collection Vehicles in MGM..... | A9-4 |
| Table 9-4: Required Number of Collection Vehicle in Cimsa | A9-5 |
| Table 9-5: Required Number of Container in Cimsa..... | A9-5 |
| Table 9-6: Composition for Non-Compostable Wastes in MGM..... | A9-6 |
| Table 9-7: Typical Materials Specifications that Affect the Selection and Design of Processing Operations for MSW in MGM | A9-7 |
| Table 9-8: Methods Used for the Processing and the Recovery of Individual Waste Components from MSW | A9-8 |
| Table 9-9: Work Schedule for Sorting Plant in MGM | A9-9 |
| Table 9-10: Design Parameters of Sorting Plant in Cimsa | A9-11 |
| Table 9-11: Equipment of the Sorting Plant in Cimsa..... | A9-13 |
| Table 9-12: Staff Allocation Schedule for Sorting Plant in Cimsa..... | A9-17 |

| | |
|---|-------|
| Table 9-13: Composition of the Compostable Waste in MGM..... | A9-18 |
| Table 9-14: Comparison of Aerobic and Anaerobic Composting for Organic Fraction of Municipal SW | A9-19 |
| Table 9-15: Comparison of Composting Method | A9-20 |
| Table 9-16: Methods Used for the Processing and the Recovery of Individual Waste Components from MSW | A9-21 |
| Table 9-17: Work Schedule for Compost Plant in Cimsa | A9-25 |
| Table 9-18: Design Parameters of Compost Plant in Cimsa..... | A9-27 |
| Table 9-19: Quantity and Quality of Compost Product in Cimsa..... | A9-28 |
| Table 9-20: Staff Allocation Schedule..... | A9-36 |
| Table 9-21: Outline of the Cimsa Disposal Site | A9-39 |
| Table 9-22: Final Disposal Amount in Cimsa | A9-40 |
| Table 9-23: Disposal Capacity by Phase in Cimsa | A9-40 |
| Table 9-24: Average Precipitation and Evaporation at Mersin..... | A9-44 |
| Table 9-25 : Comparison of Leachate Quality..... | A9-44 |
| Table 9-26 : Comparison of the Leachate Quality from the Existing Landfill Sites | A9-45 |
| Table 9-27: Effluent Standards | A9-46 |
| Table 9-28: Design Criteria for Alternative Leachate Treatment | A9-48 |
| Table 9-29: Forecast for the Size and Type of Surface Cover of the Landfill Sections in Cimsa | A9-49 |
| Table 9-30: Average Daily Precipitation in Mersin..... | A9-51 |
| Table 9-31: Each Pond Volume..... | A9-51 |
| Table 9-32: Results of the Calculation in Cimsa | A9-53 |
| Table 9-33: Personnel and Heavy Vehicle Plan for Disposal Site in Cimsa | A9-56 |
| Table 9-34: Target Wastes to be Disposed at Medical Waste Disposal Site in Cimsa... | A9-57 |
| Table 9-35: Basic Concept of Preliminary Design of Medical Waste Final Disposal Site in Cimsa | A9-61 |
| Table 9-36: Outline of the Medical Waste Final Disposal Site in Cimsa..... | A9-62 |
| Table 9-37: Final Disposal Amount in MGM (2002-2020)..... | A9-63 |
| Table 9-38: Volume of the Medical Waste Final Disposal Site in Cimsa | A9-64 |
| Table 9-39: Foundation of Final Disposal Site(Article 34) in Cimsa..... | A9-64 |
| Table 9-40: Structure of Floor of Medical Waste Disposal Site(Article 35) in Cimsa... | A9-64 |
| Table 9-41: Structure of Top Cover of Medical Disposal Site in Cimsa..... | A9-65 |
| Table 9-42: Construction Works in 1992 and their Present Landfill Condition in MGM | A9-67 |
| Table 9-43: : Unit Cost in Cimsa | A9-71 |
| Table 9-44: Investment Cost of Construction of Municipal Solid Waste Landfill Site (Phase1,Phase2) & Administration Area | A9-73 |
| Table 9-45: Investment Cost of Construction of Municipal Solid Waste Landfill Site (Phase3) | A9-74 |
| Table 9-46: Investment Cost of Construction of Medical Solid Waste Landfill Site | A9-74 |
| Table 9-47: Investment Schedule for Municipal Solid Waste Landfill Site in Cimsa (2002-2005) | A9-75 |
| Table 9-48: : Investment Schedule for Medical Solid Waste Landfill Site in Cimsa (2002-2005) | A9-75 |
| Table 9-49: Procurement Schedule for Vehicle & Equipment of Municipal Solid Waste Landfill Site in Cimsa (2002-2005)..... | A9-75 |
| Table 9-50: Investment Schedule for Vehicle & Equipment of Municipal Solid Waste Landfill Site in Cimsa (2002-2005)..... | A9-76 |

| | |
|--|-------|
| Table 9-51: Procurement Schedule for Vehicle & Equipment of Medical Solid Waste Landfill Site in Cimsa (2002-2005) | A9-76 |
| Table 9-52: Investment Schedule for Vehicle & Equipment of Medical Solid Waste Landfill Site in Cimsa (2000-2005) | A9-76 |
| Table 9-53: Investment Cost of the Sorting Plant in Cimsa | A9-77 |
| Table 9-54: Investment Schedule of Sorting Plant in Cimsa (2000-2005) | A9-77 |
| Table 9-55: Investment Cost of the Compost Plant in Cimsa | A9-78 |
| Table 9-56: Investment Schedule of Compost Plant in Cimsa | A9-79 |
| Table 9-57: Procurement Schedule of Container for Separate Collection in Cimsa | A9-79 |
| Table 9-58: Investment Schedule for of Container for Separate Collection in Cimsa ... | A9-79 |
| Table 9-59: Procurement Schedule of Collection Vehicle in Cimsa | A9-79 |
| Table 9-60: Investment Schedule for of Collection Vehicle in Cimsa | A9-80 |
| Table 9-61: Operation & Maintenance Quantities of Municipal Solid Waste Final Disposal Site in Cimsa | A9-80 |
| Table 9-62: Operation & Maintenance Cost of Medical Solid Waste Final Disposal Site in Cimsa | A9-81 |
| Table 9-63: Operation & Maintenance Cost of Medical Solid Waste Final Disposal Site in Cimsa (2002-2005) | A9-81 |
| Table 9-64: Operation & Maintenance Cost of Sorting Plant in Cimsa | A9-81 |
| Table 9-65: Operation & Maintenance Cost of Compost Plant in Cimsa | A9-81 |
| Table 9-66: Annual Operation & Maintenance Cost for One Collection Vehicle | A9-82 |
| Table 9-67 Operation & Maintenance Cost of Collection Vehicle in Cimsa | A9-82 |

List of Figures

| | Page : |
|---|--------|
| Figure 9-1: Overall CIMSA Site Development Plan | A9-3 |
| Figure 9-2: Diagram of Sorting Process | A9-8 |
| Figure 9-3: Process Flow Diagram of the Sorting Plant in Cimsa | A9-12 |
| Figure 9-4: Material Balance of the Sorting Plant in Cimsa | A9-13 |
| Figure 9-5: Layout of the Sorting Plant in Cimsa | A9-14 |
| Figure 9-6: Major Composting Systems | A9-20 |
| Figure 9-7: Hammer Mill | A9-22 |
| Figure 9-8: Selective Crushing Separator | A9-23 |
| Figure 9-9: Trommel Screen | A9-24 |
| Figure 9-10: Magnetic Separator | A9-24 |
| Figure 9-11: Process Flow Diagram of the Compost Plant in Cimsa | A9-29 |
| Figure 9-12: Material Balance of the Compost Plant in Cimsa | A9-30 |
| Figure 9-13: Layout of Proposed Compost Plant in Cimsa | A9-31 |
| Figure 9-14: Layout of the Pre-treatment Section in Cimsa | A9-33 |
| Figure 9-15: Layout of the Composting Area (Static Piles) in Cimsa | A9-34 |
| Figure 9-16: Layout of the Primary Screen Equipment in Cimsa | A9-34 |
| Figure 9-17: Design of the Cimsa Disposal Site | A9-38 |
| Figure 9-18: Diagrams of the Landfill's Impermeable Strata (Bottom and Slope) | A9-41 |
| Figure 9-19: Control Facilities and Approach Road in Cimsa | A9-42 |
| Figure 9-20: Recirculation of Leachate in Cimsa | A9-47 |
| Figure 9-21: Proposed Waste Stabilisation Ponds Process in Cimsa | A9-49 |
| Figure 9-22: Layout of Proposed Leachate Treatment Facility in Cimsa | A9-52 |
| Figure 9-23: Gas Removal Facility in Cimsa | A9-55 |

| | |
|---|-------|
| Figure 9-24: Proposed Medical Waste Disposal Site in Cimsa | A9-59 |
| Figure 9-25: Diagrams of the Landfill's Impermeable Strata (Slope, Top Cover and Bottom) | A9-66 |
| Figure 9-26: Layout of the Present Landfill of MGM | A9-68 |
| Figure 9-27: Overall Plan of the Rehabilitation of Present Landfill..... | A9-70 |

9 Preliminary Design of Cimsa Site Development

9.1 Outline of the Priority Projects

9.1.1 Selection of the Priority Projects

a. Selection of the Priority Projects

Following to the selection of the best scenario made by Mersin GMs, the priority projects were decided and agreed by the Turkish counterpart and the team as described below.

- Introduction of a separate collection system
- Construction of a sorting plant
- Construction of a compost plant
- Construction of Cimsa MSW disposal site
- Construction of Cimsa medical waste disposal site

b. Targets of the Priority Projects

The priority projects aim to conduct Phase 1 (2000 - 2005) improvement of the SWM M/P. The targets between 2000 and 2005 are summarised in the tables below.

Table 9-1: The Targets of the Priority Projects for Mersin GM

| Components | Phase | 1998 | 2002 | 2003 | 2004 | 2005 |
|---|-------|----------------|----------------|----------------|----------------|----------------|
| 1. MSW Generation | | | | | | |
| Population in Mersin GM | | 634,850 | 718,412 | 741,141 | 764,660 | 788,999 |
| Akdeniz DM | | 255,516 | 276,579 | 282,111 | 287,753 | 293,508 |
| Troslar DM | | 234,024 | 268,548 | 277,947 | 287,675 | 297,744 |
| Yenisehir DM | | 145,310 | 173,285 | 181,083 | 189,232 | 197,747 |
| MSW Amount (ton/year) | | | | | | |
| Generation | | 162,790 | 204,035 | 216,080 | 228,125 | 241,995 |
| Discharge | | 155,125 | 196,892 | 209,250 | 221,243 | 235,060 |
| Collection | | 148,555 | 192,654 | 205,595 | 218,171 | 232,572 |
| 2. Separate Collection | | | | | | |
| Separate collection rate to refuse collection (%) | | 0 | 30 | 30 | 30 | 30 % |
| Separately collected amount (ton/year) | | 0 | 57,796 | 61,678 | 65,451 | 69,772 |
| 3. Sorting plant | | | | | | |
| Treated amount (ton/year) | | 0 | 23,696 | 26,522 | 28,798 | 32,095 |
| Recovered amount (ton/year) | | 0 | 5,687 | 6,365 | 6,912 | 7,703 |
| Residue amount (ton/year) | | 0 | 18,009 | 20,157 | 21,886 | 24,392 |
| 4. Compost plant | | | | | | |
| Treated amount (ton/year) | | 0 | 34,100 | 35,156 | 36,653 | 37,677 |
| Compost amount (ton/year) | | 0 | 6,138 | 6,328 | 6,598 | 6,782 |
| Residue amount (ton/year) | | 0 | 1,364 | 1,406 | 1,465 | 1,507 |
| 5. MSW Final Disposal | | | | | | |
| Disposal amount (ton/year) | | 143,262 | 160,799 | 172,780 | 183,736 | 196,729 |
| Landfill volume (m ³ /year) | | 214,893 | 241,199 | 259,170 | 275,604 | 295,094 |
| 6. Medical Waste Final Disposal | | | | | | |
| Disposal amount (ton/year) | | 548 | 694 | 730 | 767 | 803 |
| Landfill volume (m ³ /year) | | 1,409 | 1,785 | 1,877 | 1,972 | 2,065 |

9.1.2 CIMSA Site Development

a. Overall Site Development Plan

a.1 Fundamental Issues

The important issue on the planning of the site development is the fact that no one in the world likes to have SWM facilities, especially a landfill, i.e., NIMBY (Not In My Back Yard) syndrome. In case of Mersin the situation is worse because an awful open dumping, currently operating at the compost plant landfill, is a general impression of the people. Although the Mersin City Development Master Plan (City M/P) designated the site as a final disposal site, the Mersin GM should pay careful attention to ease the surrounding people, i.e., giving a new image of a sanitary landfill, construction of a greenbelt along the site, etc.

Further, the overall site development plan should fully consider the other development projects, such as industrial complex development, etc. which are undergoing at the surrounding areas. In addition, this site is still currently in use as a quarry of raw materials of CIMSA cement factory. So that the topography of the site will be changed when the site development works will commence.

a.2 Overall Site Development Plan

A overall site development plan is presented in the figure below. The plan is summarised as follows:

- A 30m wide buffer zone (trees, plants) will be constructed along the boundary of the proposed CIMSA site to isolate the disposal site from the surrounding residents and thereby ease resident opposition to the operation of the site.
- Basically the landfill operation will be carried out at the cavity of the CIMSA quarry (15 ha). The compost and sorting plant will be constructed outside the cavity.
- Because the target site slopes from north to south and south-west to north-east, the leachate treatment facility will be constructed at the south-easternmost end.
- The sorting and compost plant will be constructed outside the south-eastern boundary of the quarry, in consideration of the plant space required and wastewater treatment.

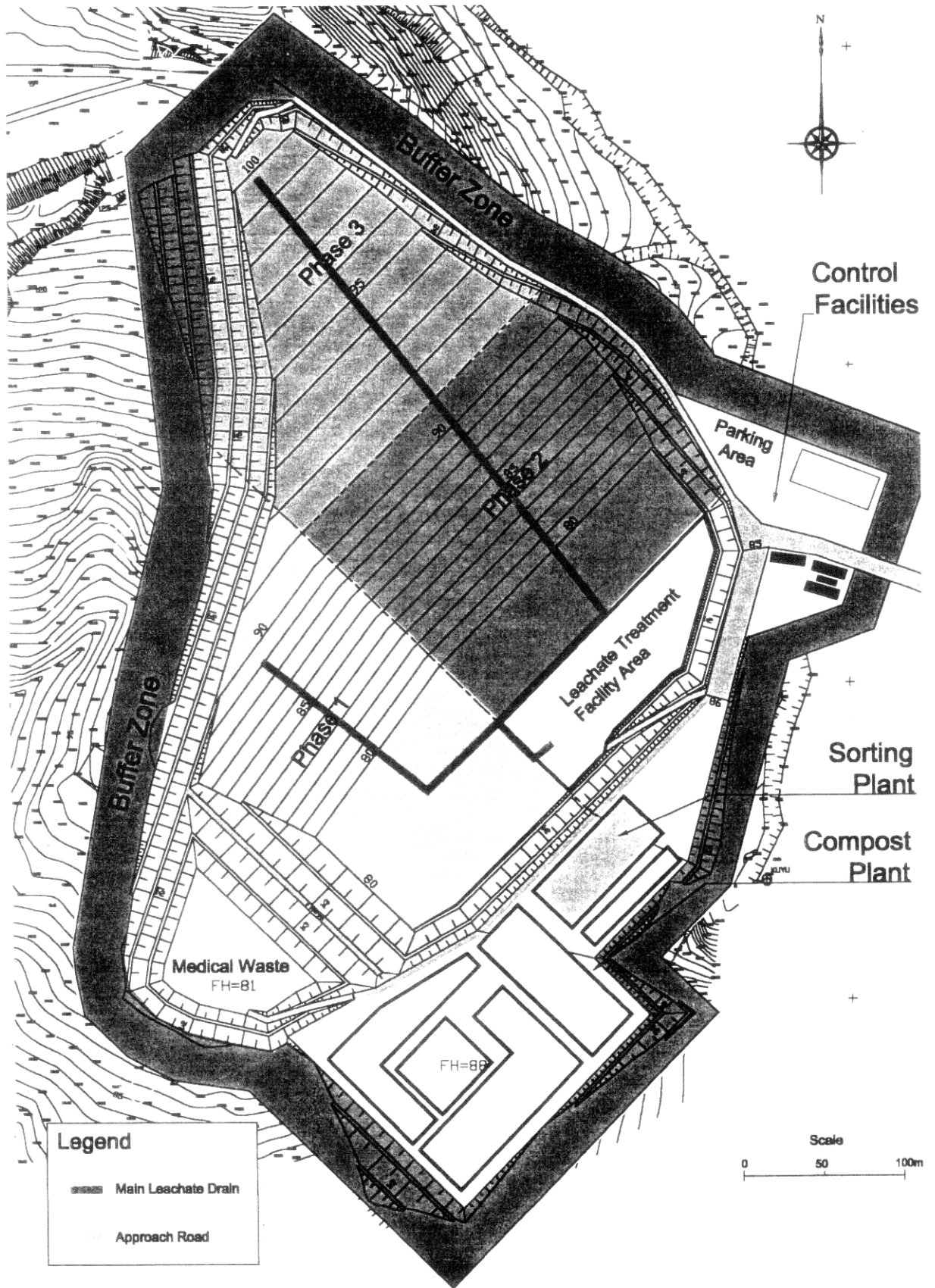


Figure 9-1: Overall CIMSA Site Development Plan