

The Algerian Experience in Managing, Removing, and Valorizing Waste: A Case Study on the Management of Technical Landfill Centers in Boumerdes Province.

التجربة الجزائرية في تسيير وإزالة وتثمين النفايات، دراسة تطبيقية على مستوى

مؤسسة تسيير مراكز الردم التقني لولاية بومرداس

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Abstract:

This study explores vital concepts related to waste, examining its origins, consequences, and the progression of waste volumes in Algeria, including their geographical spread. It scrutinizes the methodologies used for waste management and disposal across the nation, focusing specifically on practices within Boumerdes Province. The research incorporates a case study of the Technical Landfill Centers in Boumerdes, with a special emphasis on the Technical Landfill Center for Waste situated in the municipality of Corso. This facility serves as a pivotal model due to the essential daily requirement for waste collection, a consequence of the swift decomposition of materials and products. Such decomposition poses immediate risks to both environmental health and public safety.

Keywords: Waste Recycling, Waste Management and Removal, Technical Landfill for Waste, Waste Valorisation.

Jel Classification Codes : Q52 ; Q53.

Abstract in Arabic:

ارتأينا في هذه الدراسة لعرض اهم المفاهيم المتعلقة بالنفايات مع ذكر أسبابها وآثارها المختلفة، وكذا تطور حجم النفايات في الجزائر وتوزيعها الجغرافي، بالإضافة إلى تحديد طريقة تسيير وتخلص من النفايات فيها، مع أخذ عينة للدراسة ألا وهي كيفية تسيير والتخلص من النفايات بشكل خاص النفايات المنزلية وما شابهها على مستوى ولاية بومرداس، ودراسة حالة مؤسسة مراكز الردم التقني لولاية بومرداس، بالإضافة أخذ عينة من بين تلك المراكز ألا وهو مركز الردم

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The Algerian Experience in Managing, Removing, and Valorizing Waste: A Case Study on the Management of Technical Landfill Centers in Boumerdes Province. / Baya Saou & Layla Mammeri

التقني للنفايات و المتواجد ببلدية فورصو كنموذج، كون هذه النفايات تتطلب جمعها يوميا، فهي ناتجة عن الاستهلاك والانتاج اليومي للسكان لمختلف المواد والمنتجات القابلة للتحلل بسرعة في الطبيعة، وأن تراكمها من شأنه الإضرار بالبيئة والصحة العامة بصفة مباشرة.

Keywords: النفايات; الردم التقني للنفايات; تسيير وإزالة النفايات; رسكلة النفايات.

Jel Classification Codes :Q52; Q53.

Introduction:

As global consumption patterns become more diverse and expand, there has been a corresponding rise in waste production both in terms of quantity and quality, escalating the risks to human health and the environment. This escalating concern is pronounced in developing countries, which confront significant challenges in disposing of their waste effectively. Despite some of these nations making concerted efforts to mitigate waste-related issues, inspired by advancements in developed countries, Algeria finds itself grappling with persistent waste management challenges.

These issues contribute to the pollution of the surrounding water, soil, and air. Several factors exacerbate this situation, including high population density, industrial activities, indiscriminate waste dumping, and a general lack of public awareness about the hazards of improper waste disposal. This ignorance notably affects the Algerian populace, further compounded by a lack of recognition of the potential benefits and economic gains from effective waste treatment and recycling initiatives.

Does Algeria possess a well-defined strategy for waste management and treatment?

To delve into this query, the study poses several subsidiary questions aimed at uncovering the nuances of Algeria's waste management strategies:

- What is the current state of waste management in Algeria?
- What methods are employed for waste disposal?
- How is waste processed and managed specifically in Boumerdes Province?

Study Methodology:

The investigation adopts an analytical approach to examine the state of waste recycling and disposal in Boumerdes Province, thoroughly delineating the study variables and encapsulating all facets of the subject while

elucidating the various capabilities and resources related to the province's technical landfill centers.

1 - The Conceptual Framework for Waste

This axis delves into the waste concept, its various classifications, associated risks and impacts, and the reasons for its proliferation.

1 – 2 - The Concept of Waste

Waste is defined variably across different studies and disciplines:

- **World Health Organization definition:** "Waste is considered garbage or refuse, items discarded by the owner, no longer desired at a specific location and time, thereby rendered valueless". (Fedam & Mohammed, 2013, p. 453)
- **World Bank definition:** "Waste encompasses items or substances that are deemed no longer valuable for use. Items capable of being recycled or reprocessed, enabling the recovery of some components for reuse, are not categorized as waste".(Abdel Jawad, 1977, p. 33)
- **French legislator definition:** As stipulated by the French law of July 15, 1976, and its 1992 amendment on recycled materials, waste is "all remnants of production, transformation, or utilization processes, or generally, any movable object discarded or forsaken by its owner".(Nabiha, 2012, p. 69)
- **Moroccan legislator definition:** "Waste includes all residuals from extraction, exploitation, transformation, production, consumption, use, and monitoring processes, broadly encompassing any item or material abandoned or disposed of by its owner to safeguard public health, sanitation, and the environment"..(Article 03, 2006)
- **Algerian legislator definition:** "Waste encompasses all residuals from production, transformation, or utilization processes, and in general any material or product and every movable object that the owner or holder intends to, or is required to, discard or eliminate" (Article 03, 2001, pp. 10-11)

1 -2 - Types of Waste

The nature of waste varies depending on its source and its level of hazard. Waste can be classified under several widely recognized categories, as follows:

First Classification: Waste is categorized as follows:(Mustafa, 2018, p. 3)

**The Algerian Experience in Managing, Removing, and Valorizing Waste:
A Case Study on the Management of Technical Landfill Centers in
Boumerdes Province. / Baya Saou & Layla Mammeri**

1. **Household and Similar Waste:** This category includes all waste generated by household activities, as well as similar waste resulting from industrial, commercial, artisanal, and other activities that, by their nature and composition, resemble household waste.
2. **Bulky Waste:** This refers to all waste produced by household activities that, due to its large size, cannot be collected alongside household and similar waste.
3. **Special Waste:** This encompasses all waste originating from industrial, agricultural, medical, and service-related activities, as well as other sectors. Owing to the nature and composition of the materials it contains, this type of waste cannot be collected, transported, or treated under the same conditions as household and similar waste.
4. **Hazardous Special Waste:** This includes any special waste that contains toxic substances likely to pose a threat to public health or the environment.
5. **Healthcare Waste:** This refers to all waste resulting from activities related to medical examination, monitoring, and preventive treatment in the fields of human and veterinary medicine.

Second classification: Algerian legislator's classification of waste:

According to Algerian Law 01-19, dated December 12, 2001, which pertains to the management, monitoring, and removal of waste, waste is classified into three distinct categories as delineated in Articles 03 and 05:

1. **Special Waste Including Hazardous Special Waste:** This category encompasses waste arising from industrial, agricultural, therapeutic, and service activities, along with other sectors. Due to the nature and components of the materials involved, this type of waste requires distinct collection, transportation, and treatment procedures separate from household and similar waste, as well as inert waste.
2. **Household and Similar Waste:** Consists of all waste generated from household activities and similar waste from industrial, commercial, and craft activities. The characteristics and components of this waste are akin to household waste.
3. **Inert Waste:** This type comprises all waste, particularly from quarrying, mining, demolition, construction, or renovation activities,

which remains physically, chemically, and biologically stable when disposed of in landfills. It is characterized by its non-reactivity and lack of contamination with hazardous substances or other elements that could potentially harm public health or the environment.

1 – 3 - Causes of Waste Proliferation

The escalation of waste is attributable to multiple factors, each playing a significant role in its increase: (Warda, 2017, pp. 11-12)

1. **Population Growth:** One of the primary drivers of waste proliferation is the significant growth of the global population, which has escalated from approximately 1.2 billion at the dawn of the 20th century to around 6 billion at the commencement of the 21st century. Presently estimated at 7 billion, it is projected to reach 9 billion by 2050, paralleled by a substantial rise in urban waste generation.
2. **Urbanization Rates:** The rate of urbanization is another critical factor influencing waste generation. It is projected that by 2050, 65% of the global population will reside in urban areas, significantly impacting waste production within these regions.
3. **City Infrastructure and Planning:** Effective urban planning that integrates environmental considerations is crucial for sound environmental management and accurate waste quantification. Currently, only 49% of global cities have established plans targeting the urban environment, with 70% to 90% of new housing in most cities of the developing world lacking official licensing, thereby complicating solid urban waste management.
4. **Economic and Social Environment:** Alterations in lifestyles, coupled with increases in living standards and consumption patterns, have led to the generation of large volumes of waste.
5. **Waste Collection Systems and Their Efficiency:** The design and appropriateness of waste collection systems significantly influence waste management. Efficiently designed systems enhance waste control, while flawed systems exacerbate waste accumulation, particularly in urban settings.
6. **Environmental Education and Awareness:** Promoting environmental education and raising awareness among community members are vital for addressing waste management challenges.

This process equips individuals with the necessary knowledge and skills to interact responsibly with their environment.

1 – 4 - Effects of Waste

1. **Health Effects:** Waste significantly impacts health, facilitating the spread of numerous diseases and epidemics either directly through contact or indirectly through environmental contamination. The accumulation of waste not only emits foul odors but also promotes the proliferation of insects and rodents, which are vectors for multiple health hazards. For example, household waste has been linked to the transmission of 42 different diseases to humans. A staggering 90% of disease cases in hospitals within developing countries are attributable to environmental pollutants, with household waste being a primary contributor. The transmission mechanisms include: (Al-Namr, 2009, pp. 16-18)
 - A. **Diseases transmitted through animals** (such as dogs and rats), including rabies, typhoid, and plague.
 - B. **Diseases transmitted through insects** (such as flies and cockroaches), including cholera and various skin diseases.
 - C. **Diseases associated with the incineration of waste:** The burning of waste materials can lead to respiratory diseases, notably lung diseases, asthma, and bronchitis.

Additionally, the release of dioxin gas during incineration poses significant health risks. A national study by the Institute for Health Surveillance in France in 2005(Al-Namr, 2009, p. 18), which analyzed the health effects on 900 individuals living near eight waste incineration units, revealed that exposure to dioxin gas can disrupt the immune and nervous systems and cause endocrine disturbances affecting reproductive functions. Dioxin gas has been classified as a carcinogenic substance since 1997.

2. Economic and Social Effects:

The management of waste carries substantial economic and social costs. Economically, the financial burden impacts the entities responsible for waste production, aligning with the 'polluter pays' principle.

The handling and treatment of municipal solid waste represent significant expenditures that ultimately strain both state and national economic resources. Socially, the presence of waste affects the psychological and

physical well-being of individuals, particularly those residing near waste disposal sites or those employed in waste management sectors. Furthermore, waste accumulation detracts from the aesthetic quality of the environment and undermines the overall urban landscape.

3. Environmental Impacts

The deleterious impacts of waste on the environment are multifaceted, affecting various natural systems:

- **Impact on Surface Water:** Waste disposal in valleys, lakes, oceans, and seas continues under the assumption that certain water bodies are reserved primarily for non-potable purposes such as irrigation, washing clothes, and watering animals. However, the presence of organic materials, chemicals, and heavy metals leads to significant environmental contamination. The effects manifest in several ways: (Warda, 2017, p. 19)
- **Water Purification Stations:** Current global technologies often fall short of completely purifying water contaminated with diverse chemical substances, failing to restore it to its pristine state.
- **Agricultural Contamination:** Pollutants permeate agricultural soils irrigated with contaminated water, undergoing various chemical and biological transformations before being absorbed by plants, vegetables, and fruits, ultimately re-entering the human food chain.
- **Aquatic Life:** Fish and other aquatic organisms, which naturally help cleanse the environment, absorb these pollutants. These substances accumulate in their bodies and are subsequently transmitted to humans through consumption.
- **Impact on Groundwater:** Proper sanitary landfilling is seldom practiced by local authorities in most countries. Even in instances where it is implemented, there is often a failure to prevent landfill leachate from contaminating the groundwater. Typically, waste is discarded in open dumps, from which leachate formed by decomposition permeates the soil and reaches the groundwater, posing severe risks to both human health and the environment. (Yahia, 2007, p. 156)
- **Impact on Air:** The decay of waste materials left in the environment emits noxious odors and leads to the production of greenhouse gases. These emissions include methane from the decomposition of organic materials and nitrogen and sulfur oxides, which contribute to acid rain formation. Such environmental alterations not only degrade agricultural soil fertility and reduce biodiversity but also exacerbate

global warming through the release of substantial amounts of carbon dioxide. (Rachida, 2008, p. 21)

- **Impact on Soil:** Waste significantly pollutes the soil, even post-landfill. Harmful bacteria, viruses, heavy metals, and toxic chemicals proliferate in the soil's lower layers, rendering it unsuitable for agricultural use. Leachate from waste dumps seeps into adjacent agricultural lands, introducing a mix of biodegradable and non-biodegradable materials that harm crops, degrade soil properties, and adversely affect plant, animal, and human health. (Warda, 2017, p. 19)

2 - The Reality of Waste Management and Removal in Algeria

This section examines the current state of waste in Algeria, focusing on its quantity, composition, and geographical distribution.

2 -1 - The Evolution of Waste Quantity in Algeria:

Algeria produces approximately 34 million tons of waste annually, with an average individual contribution of 0.8 kg per day. This volume is projected to increase to 73 million tons by 2035, corresponding with an expected population rise to 51 million. The financial implications of managing this escalating volume of waste are substantial, with current expenditures at 73 billion DZD, anticipated to reach 178 billion DZD by 2035. ("Volume of waste in Algeria will reach 73 million tons by 2035," 2018)

The composition of this waste includes 13 million tons of household and similar waste annually, with notable fluctuations observed over time. According to a 2011 report by the National Waste Agency, annual waste production was initially estimated at 11 million tons, slightly reduced to 10.8 million tons in 2012, and subsequently increased to 13.5 million tons in 2013(Hafifi, 2015, p. 166) and 13.6 million tons in 2014.

Each Algerian generates approximately 278 kg of household waste annually, influenced by daily consumption patterns. Urban centers like Algiers have a higher per capita waste generation rate of about 1.2 kg daily, compared to 0.5 to 0.8 kg in other regions. Notably, Algerians contribute more significantly to household waste production than their counterparts in other North African countries, where annual rates range between 170 and 190 kg per person.

2 – 2 - The Composition and Geographical Distribution of Waste in Algeria:

According to the 2020 report from the National Waste Agency, the waste composition in Algeria is predominantly organic at 61.7%, followed by 11.5% plastics, 11.3% textiles, 2.9% paper, 2.5% metals, 3.15% glass, and 7.45% consisting of various other wastes. The annual growth rate of waste at 3% surpasses the population growth rate of 1.5% per annum.

Algeria ranks among the top six global consumers of plastic bags, with an annual production and consumption estimated between 6.5 and 7.5 billion plastic bags. On average, each Algerian uses about 180 to 200 plastic bags annually, opting for these due to their lower cost relative to the more environmentally burdensome paper bags. Despite their affordability, plastic bags pose significant environmental hazards, being non-biodegradable and detrimental to public health and the environment.

The industrial sector contributes significantly to hazardous waste, producing approximately 185,000 tons annually. This includes 85,000 tons of metal waste, petrochemical residues, 25,000 tons of zinc-contaminated sludge, 4,000 tons of organic solvents and paint residues, and 2,000 tons each of metallic solutions, electroplating sludge, and plastic manufacturing residues. (Mohammed, 2010, p. 131)

Waste production is notably more concentrated in Algeria's northern regions, influenced by higher population densities, diverse consumption patterns, and the prevalence of economic and industrial activities that vary regionally.

2 – 3 - The Reality of Waste Management and Disposal Methods in Algeria:

Algeria has mobilized human and material resources for waste transportation, collection, and disposal, although these efforts remain modest relative to the burgeoning volume of waste and the limited disposal sites available.

1. Human and Material Resources:

There are approximately 20,000 agents tasked with cleanliness operations across the country. Capacity building for these agents is estimated at 4% in medium-sized cities and ranges from 7% to 10% in major cities. Despite these efforts, the ratio of one agent per 1,500 residents in major urban areas is considered modest compared to international standards.

In terms of material resources, Algeria utilizes 4,100 waste transportation trucks that operate under challenging conditions, especially in rough terrain areas. These trucks, often old and inadequately maintained, frequently lose

part of their cargo en route to treatment and disposal facilities, further exacerbating public health and environmental challenges. A significant number of these trucks are also frequently out of service, which hampers the efficient transportation of household waste.

2. Waste Disposal Methods in Algeria:

Algeria employs various waste disposal methods, including:

- **Direct Dumping (Public Dumps):** The most prevalent method, accounting for 60 to 65%, involves over 2,100 random dumps nationwide, including 350 in forty major cities, covering a total area of 22,000 hectares.
- **Sanitary Landfill (Controlled Dumps and Landfill Centers):** This method, where waste is disposed of in sanitary landfill sites and controlled dumps, accounts for 30 to 35% of waste disposal.
- **Incineration:** Incineration processes account for between 5 to 10% of waste disposal practices.

2 – 4 - Valorization of Waste in Algeria

Over the past decade and a half, the Ministry of Environment has allocated \$2 billion towards the development of infrastructure and foundational structures for 1,200 projects that focus on waste valorization. Despite these substantial investments, the progress in this sector has been impeded by the lack of a robust policy framework to cultivate the household waste market effectively. Current data from the Ministry of Environment indicate that of the waste materials amenable to recovery, only a fraction is actually recycled: (Hafifi, 2015, p. 246)

- **Paper:** Out of 385,000 tons eligible for recycling, just 40,000 tons are processed, 36,000 tons are repurposed into new paper products and the remaining 4,000 tons into cardboard.
- **Plastics:** From 130,000 tons potential, only 12,000 tons undergo recycling processes.
- **Metals:** Of the 100,000 tons that could be recycled, merely 20,000 tons are actually processed.
- **Textiles:** While 60,000 tons could be reprocessed, only a third of this potential is realized.

- **Other materials:** An additional 95,000 tons of various materials are processed annually.

Despite the significant potential for recycling, the overall recycling rate in Algeria remains at a modest 7% of total waste production, with the market valued at 38 billion DZD. Notably, organic fertilizer production from waste constitutes less than 1% of this percentage. ("Waste Valorization: only 7% of produced waste is valorized," 2019) Projections suggest that recycling 20% of the waste could generate revenues of 3.5 billion Algerian dinars. However, due to suboptimal recycling practices, the nation incurs an economic loss estimated between 300 and 400 million euros annually.

3 - Waste Management and Recycling in Boumerdes Province

This section delves into the dynamics of waste management and recycling within Boumerdes Province, emphasizing the development of Waste Management Centers at the provincial level and the involvement of key stakeholders.

3 - 1 - Waste Volume in Boumerdes Province

As reported by the Provincial Directorate of the Environment, the daily waste production in 2017 was estimated at 661 tons, averaging 0.6 to 0.8 kg per person per day, which annually accumulates to about 255 kg per citizen. This figure significantly surpasses the global average of 185.7 kg per year. Within the national context, Boumerdes Province is a notable contributor to waste generation, with the municipalities of Khemis El Khechna, Boudouaou, Bordj Menaiel, Ouled Moussa, and Boumerdès city leading in waste production, with daily outputs ranging from 47 to 87 tons.

Waste Treatment and Recycling Coverage By 2017, the waste treatment and recycling coverage in the province reached 64%. It was anticipated that by 2020, comprehensive waste treatment and recycling services would be extended to all municipalities, aiming to phase out public dumps. The province also handles significant quantities of special waste, including medical and laboratory waste, which total approximately 490 tons annually.

Economic Impact and Employment Generation The recycling initiatives in Boumerdes are expected to foster economic growth by facilitating the creation of hundreds of small enterprises under the National Agency for Youth Employment Support (ANSEJ), complementing the existing 130 small enterprises.

This sector is projected to generate over 450 million DZD annually for the municipalities. To date, 32 urban waste management plans have been

**The Algerian Experience in Managing, Removing, and Valorizing Waste:
A Case Study on the Management of Technical Landfill Centers in
Boumerdes Province. / Baya Saou & Layla Mammeri**

formulated in the province, with 28 already approved and four under review. The Directorate of Environment has urged municipalities to renew and update their waste management plans within the current year to enhance efficiency and environmental sustainability.

Table (1): Quantity of Waste Produced by Various Municipalities of Boumerdès Province for the Year 2024

District	Municipality	Population	Individual Rate (kg/resident/day)	Waste Quantity (tons/day)
Thenia	Thenia	23,302	0.81	19.12
	Ammal	9,262	0.64	5.93
	Beni Amrane	25,773	0.82	21.13
	Souk El Had	7,742	0.72	21.13
Isser	Isser	36,362	0.74	26.91
	Chaabet El Ameer	36,373	0.60	21.82
	Si Mustapha	13,683	0.75	10.26
	Timezrit	11,090	0.62	6.88
Bordj Menaïel	Bordj Menaïel	76,205	0.94	71.63
	Ras Djinet	23,593	0.79	18.64
	Leghata	15,006	0.88	13.21
	Zemmouri	30,598	0.91	27.84
Naciria	Naciria	24,697	0.79	19.51
	Ouled Aissa	8,626	0.71	6.12
Baghlia	Baghlia	19,280	0.65	12.53
	Taourga	8,742	0.66	5.77
	Sidi Daoud	18,041	0.75	13.53
Dellys	Dellys	32,718	0.74	24.21

	Afir	15,108	0.72	10.88
	Ben Choud	11,147	0.65	7.25
Boumerdes	Boumerdes	45,506	0.80	36.40
	Corso	24,088	0.88	21.20
	Tidjelabine	21,164	0.77	16.30
Boudouaou	Boudouaou	83,651	0.94	78.63
	Boudouaou El Bahri	16,918	0.80	13.53
	Keddara	9,321	0.63	5.87
	Ouledhadaj	33,762	0.83	28.02
	Kharouba	12,640	0.82	10.36
KHemis El Khechna	KHemis El Khechna	86,704	0.80	69.36
	Hamadi	47,414	0.80	37.93
	Larbatache	21,392	0.67	14.33
	Ouled Moussa	52,921	0.82	43.40
Total for the Province	/	902838	24.45	724.04

Source: Data provided by the Provincial Institution for the Management of Technical Landfill Centers of Boumerdes, based on 2024 statistics from the Directorate of Environment of Boumerdes Province.

3 – 2 - Establishment of the Waste Management Centers of Boumerdes Province (EPWG-CET)

The Provincial Waste Management Centers of Boumerdes (EPWG-CET) were officially established by the joint ministerial decree on 12/02/2012, following the deliberation by the Provincial People's Assembly No. 02/2011 dated 18/01/2011, and received ministerial approval through decree No. 12/05 dated 01/03/2012. The principal headquarters of this institution is located in Oued Smar at the Technical Landfill Center of Corso, with additional administrative offices situated at the provincial headquarters.

This public institution, characterized by its commercial and industrial nature, is primarily tasked with executing public service duties that include waste removal and landfill operations. Additionally, it possesses the flexibility to expand its activities to accommodate evolving requirements and new developments. The governance structure of the institution is overseen by a board of directors, chaired by the governor or his representative.

The board comprises 13 members, including directors from ministerial sectors responsible for budget programming and monitoring, state property, local administration, agriculture, environment, urban planning and architecture, tourism, and water resources. Also included are the head of the health and environment committee of the Provincial People's Assembly and the presidents of the people's councils of the municipalities of Corso, Thenia, Zemmouri, and Boumerdès. Operations commenced on 01/01/2014, with a director appointed by provincial decree.

The institution is currently revising its organizational structure, transitioning from offices to services to enhance operational efficiency. This restructuring has led to the integration of previously separate offices, such as the Technical Service Office and the Public Procurement Office, into unified departments. Notably, new branches have been established, enhancing the institution's service delivery across the province:

1. **MADI-NET Branch:** Inaugurated in 2017 (provincial decree number 545 dated 02/03/2017), this branch is dedicated to sweeping roads and collecting waste across 12 municipalities, including Dellys, Bordj Menaiel, Thenia, Tidjelabine, Souk El Had, Boumerdès, Boudouaou, Khemis El Khechna, Ouled Moussa, and Zemmouri.

2. **MADI-VERT Branch:** Launched in 2017 (provincial decree number 2610 dated 14/11/2017), it focuses on the creation, renewal, and maintenance of public gardens.
3. **MADI-Light Branch:** Established in 2018, it is responsible for the installation, renewal, and maintenance of public lighting systems.
4. **MADI-Plage Branch:** Started in 2017, tasked with cleaning the beaches during the summer seasons.

Technical Landfill Centers: The institution manages three main technical landfill centers:

- **Qourso Center:** Commenced on 01/12/2013, designated for household waste and similar (Category 2).
- **Sghirat Center:** Located in Thenia, operational since 10/06/2013, designated for inert waste and others (Category 3).
- **Zaatra Center:** Recently launched in Zemmouri (Category 2), dedicated to household waste and similar.

These centers play a pivotal role in the province's waste management strategy by not only disposing of waste but also recovering recyclable materials such as plastics, cardboard, aluminum, and iron. The recovered materials are subsequently sorted, technically landfilled, or sold, contributing to the sustainability efforts of the region.

Human and Material Capabilities: As of 2023, the institution boasts a workforce of 596 employees distributed across its technical landfill centers and the MADI-NET branch, marking a significant increase from the 421 total in 2020 and 2021. This growth underscores the institution's ongoing commitment to enhancing waste management infrastructure and capabilities within Boumerdes Province.

**The Algerian Experience in Managing, Removing, and Valorizing Waste:
A Case Study on the Management of Technical Landfill Centers in
Boumerdes Province. / Baya Saou & Layla Mammeri**

**Table (2): Distribution of Employees and Workers of the Institution for
the Management of Technical Landfill Centers in Boumerdès for the
Year 2024**

Employee and Worker Category	Technical Landfill Centers			MADI-NET Branch
	Qourso Center	Sghirat Center	Zaatra Center	
Executives	21	01	/	01
Control Agents	07	02	/	04
Operational Agents	402	12	06	140
Total	430	15	06	145

Source: Data provided by the Provincial Institution for the Management of Technical Landfill Centers in Boumerdes

- Regarding the health and safety standards for workers from diseases resulting from the center's activities, the institution monitors the health files of the concerned individuals through periodic examinations (vaccination records) and also provides protective equipment against diseases and hazards.
- In the field of training, the institution has programmed training courses and study days for its employees and workers, especially in the following topics: financial and accounting system; human resource management; waste collection and sorting; public procurement law.
- **Material capabilities:** Except for the Bull Dozer deployed by a provincial decree and used at the Sghirat center, the equipment used by the institution is rented from municipalities or private entities.

Regarding the means used by the institution inside its technical landfill centers, they can be listed as follows:

Table (3): Equipment Used at Technical Landfill Centers for the Year 2022

Equipment Type	Quantity
Retro-loader	1
Dump truck	10
Crawler excavator	1
Sheep's foot compactors	2
Bull Dozer	2
Tanker truck	1
Total	17

Source: Data provided by the Provincial Institution for the Management of Technical Landfill Centers in Boumerdès

Note that some equipment has been transferred from the municipalities of Boumerdes and Ouled Hedadj by resolutions of the concerned municipal councils, and here is the status of the equipment transferred to the MADI-NET branch:

Table (4): Status of Equipment Transferred from Municipalities to the MADI-NET Branch

Designation	Quantity	Equipment Condition	Current Status
Dump Truck Compactor	8	6 broken	8 operational
High Tonnage Dump Truck	3	all broken	2 operational
High Tonnage Truck	1	broken	broken
Ampli Roll Truck	1	broken	operational
Tractors	3	2 broken	1 operational

**The Algerian Experience in Managing, Removing, and Valorizing Waste:
A Case Study on the Management of Technical Landfill Centers in
Boumerdes Province. / Baya Saou & Layla Mammeri**

Light Commercial Vehicles	4	all broken	all broken
G9 Transport Vehicles	1	broken	broken
Sweeping Machines	2	2 broken	1 operational
Retro-loader	1	medium condition	operational
Total	24	20 broken	14 operational

Source: Data provided by the Provincial Institution for the Management of Technical Landfill Centers in Boumerdes

From the data presented in the table, it is clear that although 24 waste collection vehicles have been repurposed for use by the Madinat branch, the majority remain inoperative, with the enterprise shouldering the costs of repairs. Concurrently, additional vehicles continue to be non-functional.

3 – 3 –Those dealing with Technical Landfil Centers Managemment Corporation of Boumerdes State:

In relation to the stakeholders of the Technical Landfill Management Corporation of Boumerdes Province, the corporation maintains cooperative engagements with local communities and both public and private institutions through formal agreements. Since the corporation began its operations, the fee for waste disposal at the technical landfill has been regulated by board resolutions.

On April 15, 2013, the board established the disposal fee at DZD 800.00 per ton for local communities and DZD 1200.00 per ton for professional entities and artisans. In December 2023, a total of 40,284.45 tons of waste was recorded, with an estimated average monthly intake of 35,000 tons persisting into 2024. From 2020 onwards, the fee for waste disposal was revised to DZD 3200 for contracted municipalities, DZD 800 for other municipalities, and DZD 1700 for private entities. Notably, contracts with various stakeholders have been executed as follows:

- A. **Municipalities:** This includes contracts with 18 municipalities such as Khemis El Khechna, Ouled Moussa, Hamadi, Boudouaou, Boudouaou El Bahri, Bouzegza Keddara, Ouled Hedadj, Kharouba, Boumerdès, Corso, Tidjelabine, Thenia, Souk El Had, Shaaba El Aamir, Ammal, Dellys, Afir, Taourga. Remarkably, the municipality

of Corso is exempt from the disposal fees. The total annual amount from these contracts amounts to DZD 90,299,169.79.

- B. **Public institutions:** Specifically, Netcom and Extranet have collectively contributed DZD 277,047,650.89.
- C. **Private stakeholders:** There are 153 private entities involved, contributing a total of DZD 16,739,856.69.

Furthermore, 12 entities engage with the Petite Center, amassing DZD 269,711.09, inclusive of the municipalities of Dar El Beida and Bordj El Bahri from Algiers Province. Additionally, the corporation interacts with 16 other municipalities from Algiers Province, including El Harrach, Bachdjarrah, Borouba, Oued Smar, El Kalitouss, Rouiba, Heraoua, Reghaia, Bab Ezzouar, Mohamadia, Bordj El Kiffan, El Marsa, Ain Taya, Maqaria, Baraki, Sidi Moussa. The special waste directed to the Corso Center from these municipalities is estimated at 1,438,902.00 tons annually, which constitutes 35% of the waste processed there. The total revenue accrued from this operation in 2015 was DZD 408,848,624.77.

In 2017, the majority of the waste processed at the Petite Center originated from INERGA, accounting for 54%, followed by 14% from Faienceries Algériennes and 6% from Cosider, among other contributors such as Corso Ceram and GCB Boumerdes, including the municipality of Dar El Beida.

Table No. (5): Waste Quantities Received at Technical Landfill Centers (2020-2025)

Centers	Waste Quantity (tons)/Year 2015	Waste Quantity (tons)/Year 2020	Waste Quantity (tons)/Year 2025
Petite Center	Undefined	47,522	140,119
Corso Center	40,284.45	499,108	510,030
Zaatarah Center	/	/	Recently Operational
Total	40,284.45	546,630	650,149

Source: Data provided by the Provincial Enterprise for the Management of Technical Landfill Centers of Boumerdes.

The Algerian Experience in Managing, Removing, and Valorizing Waste: A Case Study on the Management of Technical Landfill Centers in Boumerdes Province. / Baya Saou & Layla Mammeri

Note: Most of the waste received at the Petite Center primarily originates from the provinces of Algiers and Blida, about 95%, and the same applies to the Corso Center (Algiers Province).

The data presented elucidates a significant uptick in waste generation, with the quantities at the Petite Center experiencing approximately a threefold increase. Specifically, the waste produced by the inhabitants of the municipalities in Boumerdès Province was quantified at 724.07 tons per day in 2020, which annualizes to approximately 264,233 tons.

3 – 4 - Operations at the Corso Technical Landfill Center

Located in the Saïd Oudia district within the Corso municipality, the Corso Technical Landfill Center is a pivotal facility for the disposal of household and analogous waste types. The center is equipped with several key infrastructures:

- An administrative building that accommodates the office of the director of the Provincial Enterprise along with other vital administrative functions such as accounting and finance, public procurement, disputes, and a medical clinic.
- Facilities for maintenance and service including a workshop and a service station.
- A cafeteria and a designated prayer room.
- A public weighing scale capable of handling up to 60 tons.
- Three manual sorting units, each with a daily capacity of 600 tons, although one unit is currently non-operational.
- A landfill site designed to accommodate up to 2,000,000 tons of waste.
- A leachate treatment facility with a processing capability of 120 m³ per day.
- A wastewater treatment plant.
- A parking area.
- Comprehensive security measures including alarm systems and personnel distributed across four zones in four squads, totaling 43 members.

5 - Waste Management Protocols at the Corso Technical Landfill Center

The waste management sequence at the Corso Technical Landfill Center is methodically structured into several stages:

5 – 1 - Collection and Transport:

Waste collection is executed by the municipalities via a variety of methods, including the use of differently sized and shaped containers and bags strategically placed within residential zones. Various vehicles and tools such as small carts, tractors, and specialized garbage trucks like compactors are employed. The collected waste is then transported either to public dumps or to technical landfill sites such as the Madinat branch, which operates using both its own and municipally provided resources, or occasionally, through equipment leased from private entities.

In the year 2024, the center processed a substantial 510,039 tons of household and similar wastes. Remarkably, over 72% of this waste, equating to 368,806 tons, originated from Algiers Province, predominantly from the Extranet establishment, which alone contributed 322,672 tons, accounting for 63% of the total waste handled. In contrast, waste contributions from Boumerdès Province summed up to 141,233 tons or 28% of the total. Among the municipalities, Boudouaou, Boumerdès, Khemis El Khechna, and Ouled Moussa were leading in waste contribution, with 29,665 tons, 18,828 tons, 14,705 tons, and 14,629 tons respectively.

5 – 2 - Entry of Waste Trucks into the Landfill Center:

Upon arrival, trucks loaded with waste enter the technical landfill center and proceed directly to the designated weighing bridge, commonly referred to as a swing bridge. Here, they are met by control agents who monitor and record the weight of the waste, the truck's number, its origin, and additional pertinent data using a specialized computer application. This meticulous tracking ensures accountability and precise data management of waste inflow.

5 – 3 - Sorting Process:

The sorting of waste at the landfill center is conducted through a detailed five-stage process:

- A. Trucks are directed to their specific lanes at the sorting units. Here, waste is directly unloaded onto a conveyor belt, marking the initial phase of the sorting process.

- B. The waste then moves to a second conveyor that is connected to a shredding mechanism known as a Trommel, which contains gears that cut the waste into smaller pieces.
- C. The shredded waste is transferred via a third conveyor to a fourth conveyor equipped with two sorting belts.
- D. Sorting agents manually segregate the waste; recoverable materials, predominantly plastic, are collected and placed into open metal boxes, then moved directly to designated areas for further processing.
- E. Non-recoverable waste continues along the sorting belt to a collection truck positioned beneath, where it is collected before being transported to the landfill area for disposal.

5 – 4 - Waste Recovery:

At the Corso Technical Landfill Center, specific materials such as plastic, paper, and cardboard are salvaged and processed. These materials are compressed using a pressing machine, organized, and subsequently sold to various companies and institutions showing interest in recycled materials. In 2023, the facility managed to recover 1,582.08 tons of waste from a total intake of 499,108 tons, representing a recovery rate of 0.31%. The following year, the recovery figures improved, with 3,000 tons recovered from 510,039 tons of total waste, elevating the recovery rate to 0.58%.

5 – 5 - Waste Disposal and Removal:

This final stage in the waste management process involves the transfer of non-recoverable waste to the landfill area. Here, the waste is methodically buried, effectively isolating it from the environment to prevent contamination and manage environmental impact. This stage is crucial for ensuring that only non-recoverable, non-recyclable waste is consigned to landfill, optimizing resource use and minimizing ecological footprints.

Conclusion:

Upon a thorough review of the waste management scenario in Boumerdès Province, it becomes evident that the volume of waste, particularly household and similar types, is on a consistent rise. This trend is largely driven by population growth and urban expansion within the region. Moreover, the development initiatives undertaken in recent years, including the establishment of new industrial facilities and residential areas, have

significantly contributed to the increased waste production. The strategic geographical location of Boumerdès, bordered by several provinces, further exacerbates the situation, as a considerable portion of waste from neighboring regions, particularly Algiers Province, which accounts for more than half of Boumerdès's waste, is managed at the local technical landfill centers.

Firstly – Study Results:

The analysis yields several key findings:

- The Provincial Enterprise for the Management of Technical Landfills in Boumerdes has made significant strides, particularly through the operation of facilities such as the Corso Center. These efforts have led to the substantial reduction of waste and the closure of 17 out of 28 random dumps across various municipalities. Despite these achievements, the enterprise encounters numerous challenges that hinder its capacity to effectively manage waste. These include operational inefficiencies and resource limitations that are being addressed progressively.
- The province's waste treatment and disposal efforts involve multiple stakeholders at both central and local levels. These efforts are governed by a variety of directives and supported by governmental subsidies. Nonetheless, the processes are plagued by several deficiencies, particularly at the municipal level, where there is a notable lack of rigorous and ongoing waste management oversight. This issue is compounded by the sporadic adherence to municipal waste collection plans and a frequent scarcity of necessary physical and human resources. However, this situation does not universally apply to all municipalities; some are better equipped and receive state support in the form of subsidies and permissions for new hires, enabling them to manage their waste more effectively.
- The Provincial Enterprise for the Management of Technical Landfills has been instrumental in enhancing waste management in Boumerdès, notably through initiatives such as the establishment of the Madinat branch, which has significantly eased the waste management burden on municipalities. This branch has been crucial in facilitating the disposal of waste and the removal of several random dumps. Furthermore, it has advanced the recovery and valorization of materials, underscoring its pivotal role in regional waste management efforts.

**The Algerian Experience in Managing, Removing, and Valorizing Waste:
A Case Study on the Management of Technical Landfill Centers in
Boumerdes Province. / Baya Saou & Layla Mammeri**

However, several critical challenges persist, particularly at the Corso Technical Landfill Center, which hamper the optimization of waste handling processes:

A: The sorting units at the Corso Center frequently malfunction due to the absence of primary waste sorting at the source. This results in conveyor belt disruptions, often caused by obstructive materials such as plastic bags and metals.

B: There is a notable deficiency in the operational equipment available to the enterprise, including compactors, excavators, and waste transport trucks.

C: The landfill section is plagued by poor accessibility, particularly during the winter months, due to inadequate and unsuitable pathways.

D: There are ongoing issues with the collection of debts from the municipalities of Boumerdes and Algiers Provinces, impacting financial operations.

E: The quantities of waste received frequently exceed the center's processing capacity, which is estimated at 600 tons per day, with actual intakes ranging between 1,000 and 1,500 tons per day.

F: The proximity of the center to residential areas has led to periodic protests by local residents, driven by concerns over environmental and health impacts.

G: The organizational structure of the enterprise struggles to meet its expanding needs, especially in light of new branches and increased activities.

Secondly – Proposed Solutions:

To address the current challenges, ongoing efforts are being made by the enterprise to improve the overall situation. Currently, there is a focus on revisiting the organizational structure. The board of directors has also proposed the acquisition of essential equipment, particularly trucks and excavators. This is in anticipation of the establishment of three new technical landfill centers in the municipalities of Beni Amrane, Nasiriyah, and Afir. The Directorate of the Environment is actively engaged in awareness-raising activities to convince the residents of these municipalities about the benefits of these projects.

Additionally, there are other projects in progress, including the study and construction of a monitored landfill in the municipality of Dellys. This

project aims to eliminate two random public dumps that currently serve the municipalities of Dellys and Afir. Furthermore, a study has been completed to eliminate unmonitored dumps in the municipalities of Boumerdès and Hamadi, enhancing waste management infrastructure and addressing environmental concerns in these areas.

Reference List:

1. Data provided by the Provincial Institution for the Management of Technical Landfill Centers of Boumerdes, based on 2024 statistics from the Directorate of Environment of Boumerdes Province.
2. Abdel Jawad, Ahmed Abdel Wahab. (1977). *Fundamentals of Waste Recycling*. Cairo, Arab Republic of Egypt: Al-Arabiya Publishing House.
3. Al-Namr, Mohamed. (2009). Sustainable Management of Household Waste, A Field Study of the Municipality of Constantine. (Master's Thesis). Mentouri University, Constantine, Faculty of Economic Sciences and Management.
4. H. Houda ;Electronic article dated 18/03/2019, titled: "Waste Valorization: only 7% of produced waste is valorized". Retrieved on 23/05/2024, from <http://lechodalgerie-dz.com>.
5. Electronic article issued on 06/12/2018, titled: "Volume of waste in Algeria will reach 73 million tons by 2035". Retrieved on 23/05/2024, from <http://www.algeria-eco.com>.
6. Fedam, Mohammed Ali, & Mohammed, Nabil Jasim. (2013). Risks of Child Labor in Waste Collection, A Field Study in Fallujah City. *Al-Farahidi Arts Journal*, (16), 453.
7. Hafifi, Saliha. (2015). The Management of Solid Waste and Its Relationship with Recycling for Sustainable Development. (Doctoral Dissertation). University of Algiers 3, Faculty of Economic, Commercial, and Management Sciences.
8. Law No. 00-28 dated 22/11/2006 concerning waste management and disposal. *Official Journal*, (5480).
9. Law No. 01-19 dated 12/12/2001 concerning waste management, monitoring, and disposal. *Official Journal*, (77), 10-11.

10. Mohammed, Abdel Baki. (2010). Contribution of Environmental Taxation to Achieving Sustainable Development. (Master's Thesis). University of Algiers.
11. Mustafa, Awadi. (2018). The Application of Waste Recycling Mechanisms in Small and Medium Enterprises and Their Role in Achieving Environmental Sustainability. *National Symposium on the Sustainability Issues of Small and Medium Enterprises in Algeria*. El Oued: Martyr University Ben Hamma Lakhdar, Faculty of Economic, Commercial, and Management Sciences.
12. Nabiha, Saïdi. (2012). Urban Waste Management in Algeria: Between Reality and Required Efficiency. (Master's Thesis). University of Boumerdès, Faculty of Economic, Commercial, and Management Sciences.
13. Rachida, Labed. (2008). The Management of Solid Urban Waste - Case Study of the Municipality of Ouargla. (Master's Thesis). Kasdi Merbah University, Ouargla, Faculty of Law and Economic Sciences, Department of Economics.
14. Warda, Sakhara. (2017). The Management of Solid Urban Waste and Its Impact on the Urban Environment - Case Study of the City of Bou Saada. (Master's Thesis). Mohammed Bougara University – Boumerdès, Institute of Urban Technology Management.
15. Yahia, Ounass. (2007). Legal Mechanisms for Environmental Protection in Algeria. (Doctoral Thesis). Abou Bekr Belkaid University, Tlemcen, Faculty of Economic Sciences and Management.