

Comprehensive Waste Management Strategy: Risk Control of Waste Production and Disposal

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Abstract

This paper presents a "Comprehensive Waste Risk Management Process" in response to fluctuations in the waste disposal market. Focused on AUO's facilities in Taiwan, the process encompasses planning, production, storage, and disposal phases to manage risks. The platform provides early warnings and real-time data to ensure waste management risks remain controllable.

Author Keywords

Waste Management; Sustainability; 3Rs; Real-time Monitoring; Continuous Improvement

1. Introduction

Taiwan's industrial development has grown significantly, leading to industrial waste becoming a pressing environmental issue. In 2023, the Resource Recycling Agency of the Environmental Protection Administration reported that total industrial waste generated reached 20.04 million metric tons, with general industrial waste accounting for 18.56 million metric tons (92.62%) and hazardous waste 1.48 million metric tons (7.38%). The manufacturing sector was responsible for the largest share, producing 10.76 million metric tons (53.72%). Of the waste generated by manufacturing, 17.89 million metric tons (89.27%) was reported as reused externally, entrusted for joint treatment, or self-managed, with the remaining waste either reused internally or directly landfilled.

Due to Taiwan's dense population and numerous factories, the volume of industrial waste generated is substantial, leading to a significant demand for waste management and recycling. However, the challenges faced are considerable; available land for legal landfilling is limited due to Taiwan's geographic constraints, and the establishment of new landfills is often met with public opposition and regulatory limitations related to environmental impact assessments. Thus, the management of industrial waste must pivot towards resource recovery or recycling, in line with the government's initiatives to promote a circular economy.

Nevertheless, the transformation of industrial waste into resource recovery products or their diversion to recycling facilities for repurposing has not been without difficulties. The underlying goal is to convert waste into products for alternative uses; however, these products often lack competitiveness in terms of cost, quality falls short compared to virgin materials, and there are concerns regarding product consistency. This results in constraints on downstream export opportunities and low market acceptance. Consequently, instances have arisen where industrial waste is purportedly 'recycled' yet is illegally disposed of in valleys, fishponds, and agricultural land, causing environmental pollution and resulting in significant social costs.

It becomes a pressing issue for businesses to leverage the principles of a circular economy to enhance the proportion of

waste recovery, thereby achieving source reduction and fulfilling their responsibilities for waste management. AUO Corporation has actively sought new technologies to reduce waste generation and, in response to the volatile market for waste disposal, has undertaken a thorough review of previous management models and the impacts of related events. This includes identifying potential management blind spots and pain points throughout the waste generation and end-of-life treatment processes, culminating in the establishment of a "Comprehensive Waste Management Process." By analyzing risks across the four major phases of planning, production, storage, and disposal, eight critical risk nodes have been identified. Through an intelligent management platform, AUO aims to maintain real-time oversight of critical management information, ensuring waste management risks are reduced to controllable levels and alleviating public concerns regarding the disposal of industrial waste by high-technology manufacturers.

2. Method

Comprehensive Waste Management Process:

AUO's facility in Taiwan has implemented a comprehensive process to manage changes in raw material sourcing and manufacturing, allowing for early identification and response to new waste streams, including vendor qualification and confirmation. Continuous monitoring of the waste disposal market and vendor performance is also maintained.

By integrating production data, the facility analyzes discrepancies between estimated and actual waste outputs to prevent irregular disposal and enable proactive waste transport scheduling. After waste generation, it is temporarily stored on-site, complying with regulatory requirements and actively monitored quantity of on-site storage.

For vendor qualification, regular vendor audits are conducted to assess their performance, identify high-risk vendors, and enhance management protocols. In addition, monitoring transport volumes aids in efficient coordination, while trajectory analysis minimizes the risk of illegal disposal. Through proactive planning, AUO establishes an interconnected waste management system, ensuring that waste management risks are maintained at controllable levels.

Since the implementation of the "Comprehensive Process for Waste Risk Management," we have effectively utilized abnormal news searches related to waste to issue early warnings about three environmental risks involving downstream waste management companies. Although it was clarified that the waste in question from Company A was not generated by us, we proactively terminated our partnership with this high-risk vendor to reduce legal concerns. Additionally, incidents involving a fire at Company B and a gas leak at Company C were promptly detected through our automated monitoring systems. This enabled us to swiftly identify risks in the waste transport market and redirect waste

to qualified vendors, thereby minimizing the potential for illegal disposal or on-site storage issues due to operational disruptions.

Table 1. Eight critical risk nodes of AUO waste Management

Scope	Risk node	Content
Risk management of waste vendor	Monitor news media information	Real-time monitoring waste-associated news and marketing change: <ul style="list-style-type: none"> Automated search for waste-related abnormal news, including downstream waste treatment firms, to monitor disposal risks and proactively plan countermeasures. Utilized Python and an "NLP News Recognition Module" to capture environmental news daily with 125 keywords, filtering out 62% of irrelevant news and extracting approximately 3,000 articles annually. Compiled relevant news into a list for daily email distribution; the system assigns team members for follow-up and case closure.
	Legal compliance	Real-time monitoring of vendor legal compliance: <ul style="list-style-type: none"> Establish programs for automatically search of vendor penalties Provide vendors with advance assistance to prevent operating interruption
	Real-Time GPS tracking of waste disposal Equipment	Real-time GPS trajectory monitoring: <ul style="list-style-type: none"> Integration with national agency's GPS tracking system to monitor the disposal routes of waste management vendors. The system automatically notifies responsible personnel if a vehicle stops at unauthorized locations during transit, enabling timely intervention and requiring the vendor to explain the anomaly to prevent legal risks. If suspicious patterns or frequent anomalies are reported, AUO will classify the vendor as high-risk.
	Processing and reuse load factor	Real time monitoring of vendor loading rate: <ul style="list-style-type: none"> Analyzing monthly disposal trends to ensure efficient operation
On-site risk management	The volume of temporary waste solution storage in the plant	Real-time monitoring of waste production and storage: <ul style="list-style-type: none"> Monitor wastewater storage levels and issue alerts for waste transport scheduling: <ul style="list-style-type: none"> ✓ Red Alert: Liquid level exceeds the previous year's maximum and 70% of tank capacity ✓ Yellow Alert: Liquid level exceeds 80% of the previous year's maximum and 60% of tank capacity. Assign personnel for follow-up and case resolution.
	Waste disposal contractor evaluation	On-site vendor audit based on different risk levels: <ul style="list-style-type: none"> High-risk vendors receives intervention and support Audit results and risk levels are considered during vendor qualification
	Waste disposal contractor contract management	Forewarning of expiration date: <ul style="list-style-type: none"> Six-month forewarning before expiration date of waste contracts Ensure a smooth disposal process
	Waste weight smart management	Establish intelligent on-site weighing system: <ul style="list-style-type: none"> Employ AI technology to replace human oversight Real-time and automatic update of weighing data



Figure 1. AUO Comprehensive Waste Management Process



Figure 2. Critical strategies of AUO Waste Management.

3. Conclusion

AUO Corporation continues to expand its internal circular applications within manufacturing processes, focusing on chemical reduction, reuse, and the resource recovery of waste through innovative process technologies. Core strategies include setting accurate goals during the planning phase, optimizing waste logistics, selecting suitable partners, and enhancing contract and audit management. These four dimensions are interdependent, collectively promoting a comprehensive risk management strategy that enhances resource utilization and effectively mitigates potential risks. Additionally, with advancements in digitalization and technology, the company continuously explores new management tools and platforms to further optimize waste management processes.

In terms of waste management, AUO adheres to two main directions: circular economy principles and risk control. Regarding circular strategies, the company employs a comprehensive waste management approach across research and development, manufacturing, and disposal phases, emphasizing the 3Rs: Reduce, Reuse, and Recycle. Incineration or landfilling is considered only as a final option to ensure effective utilization of environmental resources.

For risk control, AUO conducts annual assessments based on the "Environmental Consideration Identification Process" to evaluate environmental impacts and concerns. The company utilizes a comprehensive waste management platform for risk monitoring, implementing proactive warning mechanisms. This integrated process ensures that waste generated is carefully monitored to prevent malicious disposal by waste contractors, thereby eliminating operational disruptions caused by waste management issues. Moreover, this process ensures waste is handled by qualified vendors, mitigating impacts on local communities and the environment while achieving a clean production philosophy that reduces public concerns about environmental practice.

4. References

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