The Cs-137 Shrimp Tragedy: A Revolution in Quality and Supply Chain Protection Paradigms for Consolidating the Economic Competitiveness of Indonesian Shrimp.

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Abstract— The detection of Cesium-137 (Cs-137), a highly toxic, artificial radionuclide, in frozen Indonesian shrimp exports to the United States (US) market precipitated a severe crisis, significantly jeopardizing the national fisheries sector's reputation. The contamination source was traced to the downstream environment, specifically a processing facility in the Cikande Industrial Complex, Banten, presumably linked to the unintentional or illegal importation of contaminated industrial raw materials. This descriptive-analytical qualitative study utilized Documentary Research and Content Analysis on secondary data from governmental bodies (KKP, BAPETEN, BPS) and public media. The methodological contribution is the Data Source Triangulation protocol applied to official reports, statistical data, and public documentation, ensuring the consistency and rigor of the findings. The core finding confirms that the crisis exposed a profound corporate Environmental, Social, and Governance (ESG) Failure marked by deficiencies in accountability and risk management within a supporting industrial sector (metal recycling) that directly impacted the core supply chain (fisheries exports). Crucially, the government's swift, science-based, and transparent crisis response, spearheaded by BAPETEN and KKP, proved instrumental in restoring international confidence. The Novel Insight is the US FDA's subsequent designation of the KKP Quality Agency as the Certifying Entity (CE) for Cs-137-free certification. This strategic action transformed Indonesia from a reactive compliance violator into a globally recognized Standard Setting Nation. This outcome enriches Crisis Communication literature with a model focused on Science Based Regulatory Capability Enhancement. The study underscores the imperative to institutionalize this success into a proactive, integrated quality infrastructure and stricter corporate due diligence to guarantee long-term export sustainability.

Keywords— Cesium-137 (Cs-137); Crisis Communication; ESG Failure; Reputation Recovery; Standard Setting Nation

I. INTRODUCTION

The serious incident involving the detection of Cesium-137 (Cs-137) in frozen shrimp from Indonesia destined for the United States (US) market first came to light following a report by US authorities, including the Food and Drug Administration (FDA) and Customs. This discovery raised alarm because Cesium-137 (Cs-137) is a radionuclide or artificial radioactive element of crucial concern in aquatic environments. Cs-137 is a product of nuclear fission and is classified as having a high level of toxicity. Its main characteristic of concern is its ability to easily disperse or spread in water bodies [1]. .In addition, Cs-137 is a gamma radiation emitter with an energy of 661 keV, and emits beta particles. This element has an atomic number of 55 and a characteristic half-life of approximately 30 years. The potential for Cs-137 pollution in aquatic environments is largely due to fallout from nuclear experiments and industrial processes, which pose a risk of harming the health of living organisms if exposed.

After an extensive investigation by the Cs-137 Handling Task Force formed by the government, it was confirmed that the source of the contamination did not originate from upstream aspects of fisheries, namely pond cultivation, water quality, or feed, but was rooted in the downstream environment, particularly in processing facilities and factories in industrial areas . The most affected locations were identified as being around the Cikande Modern Industrial Estate, Serang, Banten, indicating a broader industrial environmental problem. The relocation of 700 kg of Cs-137 contaminated metal scrap was carried out on September 23, 2025, where BAPETEN played a role in joint supervision with the Ministry of Environment/BPLH, BRIN, and the Brimob KBRN Team, with the aim of moving the material to the temporary storage location of PT. Peter Metal Technology (PMT) [2]

It is strongly suspected that this radioactive material entered through imports of industrial raw materials, such as scrap iron powder (scrap) or other used materials, accidentally or illegally contaminated, then contaminate the shrimp processing plant area. Widespread contamination is not limited to shrimp, but has also been reported in other export commodities such as cloves and footwear, indicating a failure in the entry control of imported goods that potentially carry hazardous materials and underscoring the urgency of improving quarantine procedures and nuclear surveillance at ports.

Despite the responsive government action, coordinated by BAPETEN and the KKP (Ministry of Marine Affairs and Fisheries), successfully documenting the recovery and increase in export volume within a short period, including formal recognition by the FDA through

the designation of the KKP as a Certifying Entity, significant gaps still remain in the literature, which motivate this study.

First, this crisis was not merely a food safety failure, but also a failure of corporate governance (ESG), where the contamination originated from the non-fisheries supporting the industrial sector (scrap metal smelting). To achieve a positive objective (optimal public service or export reputation recovery), compliance with and reinforcement of governance principles are required, especially accountability and fairness within the principles of Good Governance [3]

Second, public crisis communication research generally focuses on loss mitigation; however, this study found something more transformative, such as the ability to turn a crisis into an opportunity for establishing international quality standards (Standard Setting Nation). The core of this strategy involves the effective delivery of information to various stakeholders, including employees, customers, investors, and the media. The goal is to manage and minimize the negative impact of the ongoing crisis [4]. Therefore, the lack of empirical research that details a successful Science-Based Crisis Communication and official control strategy, one that successfully converted a reputational threat into an enhancement of regulatory capability triggers the urgency of this study.

The in-depth investigation conducted by the Government of Indonesia revealed that the source of contamination was located in the downstream area, specifically within industrial zones and processing facilities, and did not originate from upstream cultivation practices (shrimp farms). Nevertheless, this incident instantly triggered a massive reputational crisis and market uncertainty, which directly impacted the economic stability of the entire supply chain, including thousands of village shrimp farmers who rely on sustained exports. Facing a threat that erodes the confidence of key trading partners and jeopardizes the sustainability of the national fisheries sector, a rapid, measured, and transformative response from the Government is of paramount urgency.

Consequently, this research presents with an extremely pressing urgency: to seek effective policy solutions for maintaining and restoring the sustainability of the shrimp sector. The main focus is on the Government's efforts to re-engineer quality governance and tighten supply chain supervision, ranging from the point of raw material import to the final product processing facilities. The ultimate objective of this research is to review the specific policy interventions undertaken by the government to anticipate such incidents, thereby assuring and demonstrating the sustainability of the domestic fisheries sector, with a particular focus on village level farmers.

II. LITERATURE REVIEW

a. Characteristics of Cs-137

Cesium-137 is a radionuclide classified as artificial or anthropogenic, meaning its presence originates from human nuclear activity. In environmental samples, Cs-137 has been found to have a tendency to accumulate in the upper layers of the soil. However, it can move to deeper soil layers through processes such as rainwater infiltration or soil biological activity, as evidenced by the detection of its specific activity at a depth of (10-20) cm in the soil samples of this study [5].

b. Radioactive Contamination in the Food Chain

Radioactive contamination of the food chain is profoundly significant because it is the primary pathway of nuclear waste's threat to human safety and health. When radioactive substances such as cesium, strontium, and plutonium are discharged into the ocean, marine organisms such as fish, algae, and other marine animals become contaminated. This automatically introduces these dangerous contaminants into the food chain and the food web, disrupting the overall ecological balance of the ocean. The most crucial impact lies in the fact that marine organisms, particularly those at the top of the food chain, can experience radionuclide accumulation, significantly increasing the risk of radiation exposure for humans who consume contaminated seafood. Long-term exposure to these radionuclides has the potential to cause serious health problems, including an increased risk of cancer and other health disorders in humans, although the effects may only become apparent over a long period of time [6].

c. Radioactivity Standards and Thresholds

The threshold limit set by BAPETEN Regulation No. 16 of 2013 for certain natural radionuclides contained in the air serves as a benchmark for radiation safety in the environment, such as Radium-226 (Ra-226) of 0.05 Bq/m^3 , Thorium-232 (Th-232) with 0.006 Bq/m^3, As well as Thorium-228 (Th-228) capacity 0.003 Bq/m^3 [7]. Cesium-137 (137Cs) in marine organisms (biota) is set at a level of 10 μGy/h (microgray per hour), based on the International Atomic Energy Agency (IAEA, 1992) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1996) [8].

d. Consumer Trust and Country Brand Reputation

The national brand image (Indonesian brand) is an intangible asset that plays a crucial

role in business competition, both in the domestic and global markets. Brands have transcended their basic function as distinguishing visual markers and now reflect the quality, image, and reputation established by a business entity. In an increasingly competitive business climate, particularly in the era of globalization, Indonesian companies must optimize the use of brands as strategic elements. A well-managed brand can create added value for consumers and differentiate products or services from those of competitors. A strong brand, widely recognized and trusted by consumers, significantly builds loyalty, strengthens a positive image, and ultimately increases the company's overall economic value [9]

III. MATERIAL AND METHODS

Research Design and Data Approach

This study employs a qualitative, descriptive-analytical research design grounded primarily in the analysis of secondary data. The core methodology relies heavily on Documentary Research , where the raw data consist of official texts, investigative reports, and comparative statistics.

The analytical focus of this research is twofold:

1. To critically examine the corporate failure in adhering to Environmental, Social, and Governance (ESG) principles , specifically focusing on the actions and negligence of the company implicated in the contamination (PT. Peter Metal Technology).
2. To evaluate the effectiveness of the government's Crisis Communication strategy (led by the Nuclear Energy Regulatory Agency/BAPETEN and the Ministry of Marine Affairs and Fisheries/KKP) in managing the incident and restoring the reputation of Indonesian shrimp exports.

This descriptive-analytical approach aims to provide a detailed chronological overview of the Cs-137 incident and subsequently offer a critical evaluation of the policy responses and their measurable impact on global market trust.

Data Selection Criteria

As a Documentary Research study, the selection of secondary data adhered to strict criteria to ensure the relevance and authority of the sources used for analysis:

1. Case-Specificity and Temporal Scope

   All data included had to be directly related to the Cs-137 contamination incident involving Indonesian shrimp exports, specifically traced back to the processing facility in the Cikande Industrial Complex, Serang, Banten, in 2025. The temporal scope focused on the critical crisis period, ranging from the initial detection and public disclosure (approximately August 2025) to the pivotal announcement of recovery and the designation of the certifying entity by the US FDA (approximately November 2025).
2. Source Authority (Pillars of Official Data

   Data were categorically sourced from official governmental and regulatory bodies directly involved in crisis management and oversight:
   a. Ministry of Marine Affairs and Fisheries (KKP): Documents related to export certification, quality assurance, and the official health communication response.
   b. Nuclear Energy Regulatory Agency (BAPETEN):
      Official investigation reports concerning the source of contamination, material safeguarding, and environmental communication.
   c. Central Statistics Agency (BPS) and Ministry of Trade
      Comparative export data utilized to quantify the economic impact of the crisis and verify the subsequent recovery.

Analytical Procedures

To ensure a robust and verifiable interpretation of the secondary data, the research adopted a multi-stage analytical procedure:

1. Qualitative Content and Thematic Analysis

   The textual data, including official press releases (KKP), investigation reports (BAPETEN), and public media coverage, were subjected to Qualitative Content Analysis. This initial step aimed to systematically identify recurring patterns, core themes, and prevailing narratives within the official and public discourse regarding the Cs-137 incident

   The analysis then progressed to Thematic Mapping, linking the empirical findings back to established theoretical frameworks:
   a. For Government Response: The communication narratives were critically mapped against the principles of Structured Crisis Communication, specifically evaluating the commitment to transparency, science-based decision-making, and official control

b. For Corporate Failure: The findings on corporate actions and negligence were analyzed against the three core dimensions of Environmental, Social, and Governance (ESG) principles, focusing on deficiencies in accountability, risk management, and prevention of environmental harm

2. Comparative Descriptive Analysis

This procedure was implemented to verify the tangible effects of both the crisis and the subsequent recovery strategy. Quantitative data from official sources (BPS/Ministry of Trade) concerning export volumes were analyzed before and after the Cs-137 incident. This comparison served to statistically verify the impact of the crisis and, crucially, confirm the effectiveness of the KKP's recovery efforts, as evidenced by the reported increase in export performance.

Validity Protocol

The validity and trustworthiness of the research findings, which rely exclusively on secondary data, were rigorously ensured through the application of the following protocols:

1. Data Source Triangulation

To establish the consistency and coherence of the findings, the study employed Data Source Triangulation. This involved systematically comparing and cross-referencing findings derived from the three established data pillars:

a. Official Governmental Reports: Data from the Nuclear Energy Regulatory Agency (BAPETEN) and the Ministry of Marine Affairs and Fisheries (KKP) were used to confirm official actions and policy responses

b. Statistical Data: Comparative export data provided by the Central Statistics Agency (BPS) and the Ministry of Trade were utilized to verify the quantifiable impact of the crisis and the subsequent recovery, serving as empirical evidence.

c. Public and Media Documentation: Reports from national and international news media were analyzed to contextualize the public perception and social narrative of the incident.

2. Theoretical Referencing Validity

To prevent arbitrary interpretation and ensure the scholarly grounding of the analysis, the study applied Theoretical Referencing Validity. This protocol ensured that:

a. Interpretation of Corporate Failure

The analysis of corporate negligence and accountability (e.g., the failure of PT. Peter Metal Technology) was directly grounded in and articulated through established concepts of Environmental, Social, and Governance (ESG) principles and Corporate Social Responsibility (CSR).

b. Evaluation of Response

The assessment of the government's communication strategy was anchored to specific theoretical frameworks of Crisis Communication and adherence to official international standards (e.g., BAPETEN regulations and IAEA guidelines).

IV. RESULT AND DISCUSSION

Biota Radiation Dose Level Screening

Based on a literature review of previous studies, the crucial threshold used to evaluate the safety of Cesium-137 (137 Cs) radiation exposure on marine organisms (biota) is set at 10 μGy/h (micrograys/hour). This screening dose limit serves to determine whether radiation exposure has the potential to cause significant biological effects. This methodology uses a Tier 2 dose screening approach and refers to guidelines recommended by the International Atomic Energy Agency (IAEA, 1992) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1996). Consequently, if the measured radionuclide concentration causes the radiation dose to exceed the screening level of 10 μGy/h, it is interpreted as having a negative impact on marine biota [8].

Analysis Corporate Social Responsibility (CSR)

Table 1 Analysis of Corporate Social Responsibility

CSR Dimensions	Description of CSR Obligations	Company Failure (PT. Peter Metal Technology) Based on Findings	Consequences
Environmental	Implement waste management according to standards, prevent pollution, and restore affected ecosystems.	Imports of scrap metal contain radiation, and the smelting process causes radioactive contamination with Cesium-137, potentially leading to long-term environmental degradation.	Damage to land, water, and vegetation. Threatening the survival of local flora and fauna. Violating Environmental Law.
Social	Pay attention to the safety of workers and the surrounding community. Provide information, education, and compensation related to existing risks.	Poses serious risks to human health (workers and the public) due to radiation exposure (CFS, cancer risk). Causes social unrest, anxiety, and uncertainty due to a lack of transparency.	Significant social and ecological losses, including immune system impairment and increased cancer risk. Indonesia's export products are negatively impacted in the global market.
Governance	Implement good and transparent governance. Maintain accountability. Implement strict risk evaluation and prevention procedures.	Lack of transparency and accountability. Failure to monitor and manage hazardous industrial waste. Negligence (culpa) in running the company and failure to adhere to the principle of prudence (duty of care).	Decreased credibility. Decreased investor confidence and the image of the national industry. Potential legal sanctions (criminal and civil) and strict liability lawsuits.

Source : Data Processed by the Researcher (2025)

Previous research findings revealed that the incident indicated the existence of structural weaknesses in the supervisory system against the flow of high-risk goods and lack of synergy and effective coordination between related agenciesSecond, the research results show that there are serious and confirmed impacts of this contamination on the implementation of the PrinciplesEnvironmental, Social, and Governance (ESG).

Specifically, it is proven that the implementation of ESG principles in the metal industry sector is still not optimal, which is indicated by low transparency, accountability, and corporate social responsibility. Third, overall, these findings reinforce the narrative that this case of radioactive contamination is clear evidence of corporate failure to balance economic interests with sustainability, social, and environmental dimensions [10]

Table 2 Reputation Recovery Strategy for Indonesian Shrimp Exports Post-Cs-137 Crisis: Analysis of Government Response, Theoretical Anchoring, and Performance Indicators

No	Central Strategy Elements	Government Actions	Theoretical Anchoring	Early Success Indicators
1	Fast & Transparent Response	Formation of Task Force Cs-137, facility audit, and product destruction.	Crisis Management (Response): Respond quickly to control the narrative and damage [11]	Media and trade partners acknowledge the seriousness of the handling
2	Systemic Quality Assurance	Implementation of the Cs-137 Certification Scheme is mandatory for exports to the US (especially Java & Lampung).	International Trade (TBT): Transforming non-tariff barriers into proactive compliance standards [12]	The Ministry of Marine Affairs and Fisheries has been designated a Certified Entity by the FDA; shrimp exports have resumed.
3	Trade Diplomacy/ Lobbying	Communication with the US FDA, seafood associations, and major retailers	National Reputation (Re-Imaging): Rebuilding Trust Capital through direct communication and concrete promises [13].	Export levels to the US and export volume targets are increasing.
4	Decontamination and Isolation	Decontamination of 22 facilities in Cikande and isolation of the source of contamination (scrap metal factory).	Crisis Management (Recovery): Eliminating the source of the hazard to prevent recurrence.	Affected facilities are declared free of contamination; focus only on the Yellow List (Java-Lampung).
5	Technical Capacity Building	Collaboration between KKP, BAPETEN, BRIN; approval of 4 Indonesian laboratories for Cs-137 testing.	Competitive Advantage (Science Based): Ensuring data-based quality and internationally recognized scientific standards [14]	The speed of the certification process has increased, Indonesia has become a global standard in the fisheries sector.

Source : Data Processed by the Researcher (2025)

Response Business Communication and Global Trust (Ministry of Maritime Affairs and Fisheries Press Release Number SP.442/SJ.5/XI/2025

a. Declaration of Success: The Indonesian government has firmly announced the reintroduction of Indonesian shrimp into the US. This breaks the narrative of crisis and confirms recovery [15].
b. US Authority Recognition: The crucial point is the designation of the KKP Quality Agency as Certifying Entity (CE) certification by the U.S. Food and Drug Administration (FDA) for Cesium-137 (Cs-137)-free certification. This is official recognition from the U.S. health authorities, which significantly enhances the credibility of Indonesia's quality system in the eyes of the global market [15].
c. Global Leadership (Standard Setting Nation): Indonesia has positioned itself as the first country in the world to obtain a radiation certification

mandate for the fisheries sector, changing the orientation from crisis reaction to becoming a standard setting nation. This is a powerful business communication message about quality capability and leadership [15]

d. Export Performance Data: The press release presents data on the increase in exports to the US by 16.3% (YoY) in the period January - September 2025, which serves as concrete evidence (supporting data) of the success of the recovery and rapid response [15]

Critical Assessment: The described actions represent a crucial step in mitigating the risk of a secondary crisis (public panic) and effectively demonstrate institutional accountability. This transparency directly counteracts speculative narratives and affirms the source is isolated and non-natural.

Communication Response Health (Food Safety)

a. Implementation Zero Compromise: The government chose the path of leadership (leadership) and adheres to the principle of zero compromise through data, science, and official controls (official control) that can be verified. This demonstrates a commitment to maintaining strict food health and safety standards [15]
b. Starting October 31, 2025, the Cs-137-free certification scheme will be fully operational. Exported products must comply with the procedures and requirements stipulated in the regulations Yellow List. This is a concrete and structured health risk management mechanism [14]

Critical Analysis: The KKP's strategy transcends mere crisis mitigation, focusing instead on the restoration of functional trust. By grounding the entire process in scientific standards and tying it to mandatory export requirements, the KKP provides the U.S. with internationally auditable evidence.

Upstream Environmental and Quality Issue Response

Important for Indonesia's environmental image, the Minister of Maritime Affairs and Fisheries emphasized that the discovery of Cs-137 is specific to local cases (site specific contamination)in one company (PT BMS Cikande-Serang),not from ponds, hatchery, or cultivation system. This separates the issue of contamination from general farming practices.

Critical Assessment: The acknowledgement that Indonesia's quality assurance system now meets or even exceeds U.S. expectations is highly significant. This success allowed the KKP to reposition Indonesia from a compliance violator to a Standard Setting Nation in the radiation fisheries sector.

V. CONCLUSION

The incident of Cesium-137 (Cs-137) contamination in Indonesian shrimp exports has been definitively proven to originate from imported radioactive metal scrap, which subsequently tainted a downstream facility within the Cikande industrial complex, Banten, and not from aquaculture practices. This crisis has yielded two major findings with significant theoretical implications:

1. Corporate Governance (ESG) Failure

   This case provides firm empirical evidence regarding the failure of corporate entities to effectively balance economic interests with sustainability dimensions. It offers a powerful case study, asserting that a failure to adhere to the Governance pillar (accountability and risk management) within a supporting sector (the metal recycling industry) can directly lead to a catastrophe in the supply chain of a core sector (fisheries exports), far exceeding traditional food safety issues.
2. Theoretical Contribution to Crisis Communication

   Drawing lessons from the demonstrated success of BAPETEN (National Nuclear Energy Agency) and KKP (Ministry of Marine Affairs and Fisheries) in transforming contamination threats into globally recognized mandatory certification, rural farmers must be incentivized to adopt a science-based regulatory capability approach. The stringent and validated implementation of such standards not only guarantees product safety but also significantly elevates market value and unlocks access to premium markets, thereby shielding farmers from the volatility of conventional commodity price fluctuations. Ultimately, this paradigm shift empowers farmers to become the stewards of their own product quality standards, a factor critical to achieving economic self-sufficiency and market resilience within Indonesia's agricultural sector.

New Insights and Policy Paradigm Shift

A novel insight from this research is that the crisis management successfully transformed a weakness into a

strategic advantage. However, this highlights the urgency of shifting the policy paradigm from reactive supervision to an integrated preventive system:

1. Integrated Quality Infrastructure Enhancement
   The accreditation by the FDA, which designated KKP as the Certifying Entity, is a national achievement. The crucial policy implication is the need for substantial and sustained strengthening of the domestic quality infrastructure (including BAPETEN and accredited laboratories) and a transparent nuclear quarantine/supervision mechanism at the entry points for high-risk imported goods. The goal is to ensure uniformity in supervision across both the fisheries export supply chain and its supporting industrial supply chains.
2. Enforcement of Corporate Due Diligence and Legal Responsibility
   This case necessitates stricter legal and policy implications, particularly through the enforcement of the duty of care and strict liability principles for companies operating in high-risk sectors like scrap metal processing. This must be integrated into the national ESG framework to prevent anomalies in one sector from damaging the reputation and economy of others, and to help protect the sustainability of rural farmers.

In conclusion, Indonesia has successfully leveraged the Cs-137 crisis to build a stronger, internationally recognized quality infrastructure. The future challenge is to institutionalize the success of this reactive response into a proactive and integrated preventive system, thereby guaranteeing the sustainability of exports and maintaining the integrity of the national brand reputation.

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