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Analysis of the Potential Application of *the PDCA* Method to Reduce *Fuel Losses* at Petrol Stations

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Abstract

Fuel oil (BBM) losses are a problem that is often faced by energy distribution service units such as Fishermen's Public Fuel Filling Stations (SPBUN), especially related to the difference between physical stock and administrative records. This study aims to analyze the conditions and patterns of fuel losses and examine the potential application of *the Plan–Do–Check-Act* (PDCA) method as a sustainable improvement approach in reducing fuel *losses* at petrol stations. This study uses a qualitative approach with a case study design. Data was collected through field observations, semi-structured interviews, and analysis of operational documents related to the process of *receiving* and dispensing fuel. The results of the study show that fuel *losses* are influenced by several main factors, including human factors (operator accuracy and recording discipline), work methods (measurement and administration procedures that have not been optimally standardized), machinery or equipment (accuracy of dispensers and measuring instruments), and operational environmental factors. The implementation of the PDCA framework shows significant potential in improving operational processes through strengthening planning, implementation of controls, periodic evaluations, and standardization of work procedures. With the systematic implementation of PDCA, companies have the potential to reduce *fuel losses*, improve stock control accuracy, and improve operational efficiency in a sustainable manner. The findings of this study are expected to be a basis for consideration for management in optimizing the fuel stock control system and improving the operational performance of SPBUNs.

Keywords: *Fuel Losses* , *Plan–Do–Check–Act* (PDCA), Stock Control, Operational Management, SPBUN

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1. INTRODUCTION

Energy is one of the basic human needs that plays an important role in supporting the economic and social activities of the community. Fuel Oil (BBM) as one of the main energy sources is a vital need for the Indonesian people, especially in the transportation, fisheries, and industrial sectors. The government through Pertamina and companies are trying to maintain the availability and distribution of fuel to remote areas through the construction of a network of Fishermen's Public Fuel Filling Stations (SPBUN). The role of SPBUN is not only to serve sales, but also to maintain the reliability of supply and the accuracy of fuel stocks so that they remain in accordance with operational standards.

However, in practice, SPBUNs often face the problem of fuel *losses*, which is the difference between the amount of physical stock and administrative records. *Losses* can be caused by various factors such as evaporation due to high temperatures, errors in the tank *sounding process*, inaccurate manual recording, mismatches in the amount of fuel deliveries from those ordered or listed on the delivery documents to leaks in the distribution pipeline. According to Pertamina's policy, the fuel loss tolerance limit is in the range of 0.25%-0.5%. If the *value* of losses exceeds this limit, this can have an impact on the operational efficiency of SPBUN and reduce the accuracy of daily stock reporting.

In addition to these general factors, *losses* at the petrol station level generally appear the most at two critical points of the operational process, namely fuel receipts *(receiving)* and fuel sales *(dispensing)*. At the receiving stage, *losses* can occur when there is a difference between the volume of fuel listed in the delivery *document (Delivery Order)* and the actual volume that enters the SPBUN storage tank, due to the influence of temperature, the remaining load in the tank truck, or improper manual measurement methods. Meanwhile, at the sales stage, *losses* can arise due to a mismatch between the results of recording dispenser meters and changes in tank stock, either due to operator error, inaccurate tool calibration, or delays in data input in the daily administration system. These two process points have a high risk because they are carried out routinely and involve interaction between humans, measuring instruments, and administrative documents.

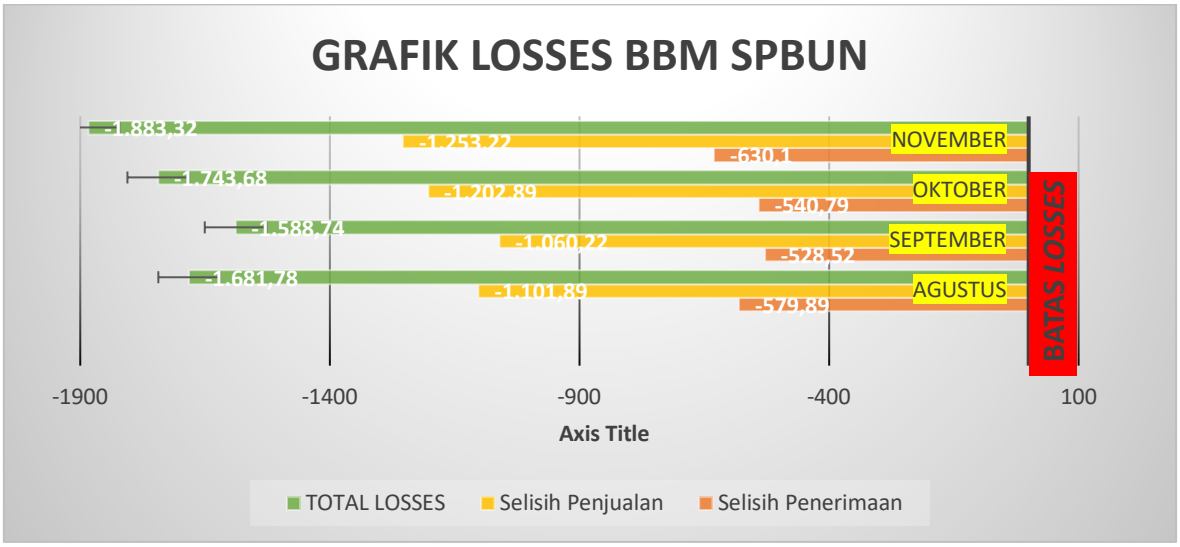

Figure 1. 1 Graphics *Losses* Pertalite Fuel Type SPBUN
Source : Data processed from the Company 2025

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Figure 1.1 shows the value of Pertalite fuel losses at petrol stations during the period from August to November 2025. Based on the graph, it can be seen that total *losses* fluctuate every month, with the highest value occurring in November at -1,883.32 liters, while the lowest value was recorded in September at -1,588.74 liters. The largest loss component came from *dispensing losses* ranging from -1,060 to -1,253 liters, followed by receiving *losses* in the range of -528 to -630 liters. These findings show that *losses* are more dominant in the distribution stage than in the receipt stage.

The difference in sales is generally influenced by *the* dispenser nozzle which is rarely re-marked so that the accuracy of fuel volume expenditure becomes less precise. This condition can be increasingly seen when there is a queue of fishermen during busy operating hours, because the filling process tends to be fast and has the potential to reduce the accuracy of verification, which ultimately increases the risk of inaccurate stock recording. Meanwhile, the difference in revenue can be influenced by several factors, including indications of reducing fuel volume by Supplier tank truck drivers on the way for personal gain, as well as the possibility of evaporation due to temperature exposure during the distribution process from the fuel terminal to the petrol station.

In the context of SPBUN, fuel receipt and sales activities take place every day with a large volume so that a small difference has the potential to become a significant loss cumulatively. The trend of increasing total *losses* from September to November indicates that there are inconsistencies in the process of measuring and recording fuel stocks, both at the receipt and distribution stages, and reinforces that stock control still tends to be reactive because corrections are only made after the difference is identified in the monthly report.

This condition shows that fuel stock control at petrol stations still tends to be reactive and has not run optimally. In fact, to maintain consistency and improving the quality of operational results to match the needs and standards set, quality control is needed to be applied to each operational process (Hadiansah & Aslamiyah, 2025). Therefore, the application of the *Plan–Do–Check–Act (PDCA)* needed as an approach *Continuous improvement* to strengthen daily controls, speed up difference detection, and suppress potential *losses* so as not to repeat in the next operational period.

The fuel loss problem analyzed in this study is also based on the results of pre-research conducted through initial observation and preliminary interviews with SPBUN internal parties conducted in November 2025. Based on an interview with ZH as the Head of Engineering and Operations, he said that,

"The operational process at the petrol station still faces technical obstacles, especially in the fuel stock storage and measurement system. The use of *surface* tanks, the unavailability of *underground tanks*, and the absence of *an Automatic Tank Gauge* (ATG) cause all stock measurements to be carried out manually using sticks. During busy operational hours and during shift changes, differences in reading results often occur, so it has the potential to cause fuel stock differences".

Meanwhile, based on an interview with SY as the Head of SPBUN Operator which was conducted in November 2025, he explained that,

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"The accuracy of the measuring instruments and dispensers used still has limitations, so there is often a difference between the physical volume of fuel and daily administrative data. In addition, corrections to stock differences are generally only made at the end of the reporting period, so small differences that occur every day tend to accumulate."

The findings of the pre-research and preliminary interviews show that the fuel stock control system at petrol stations still needs more structured and sustainable improvements. Operational conditions that have not been supported by a structured control system have the potential to cause various problems, such as mismatches in operational results, service delays, and increased risk of company losses. This shows the importance of implementing quality control and systematic operational evaluation in supporting the smooth work process (Sihabbullah & Aslamiyah, 2025)

Previous research by (Wijaya et al., 2023) shows that the cash and inventory control system at SPBUN is still weak, causing a high potential loss of fuel stocks. Meanwhile, research (Fatma et al., 2020) prove that the application of *PDCA* able to lower the level *Defect* products up to 45%, and research (Hasanain & Mahachandra, 2025) explains that the application of systematic methods such as *DMAIC (Six Sigma)* able to reduce *losses* diesel on fuel distribution at Tanjung Priok TBBM. This condition shows that the weak operational control system, especially those that are still conventional, has the potential to cause operational processes to not run optimally, as stated by (Saputra & Aslamiyah, 2024) that quality control that is still conventional causes the production process to not run optimally. However, these studies have not specifically addressed the application of the method *PDCA* in the SPBUN sector to control *losses* BBM.

Thus, this research is important to analyze more deeply the actual conditions, pattern of occurrences, and characteristics of fuel *losses* that arise, especially at the two most crucial operational stages, namely fuel receipts (*receiving*) and fuel sales (*dispensing*) at SPBUN. Through this study, it is hoped that the factors causing technical and administrative *losses* can be identified in detail , such as potential measurement errors during loading and unloading, inconsistencies in the recording of receipt documents, limited control over the use of dispensers, and weaknesses in *daily stock* monitoring procedures.

This research is a differentiator because it applies *Plan–Do–Check–Act (PDCA)* not only as a quality management concept, but as a framework for operational analysis in the energy distribution process in the petrol station sector. In addition, this research is expected to be able to uncover *the critical points* in the fuel receipt and sales workflow that are most vulnerable to causing differences, as well as mapping opportunities for work system improvement through the preparation of more structured controls, strengthening SOPs, improving recording discipline, and more routine and measurable internal audit mechanisms. In the end, the results of this study are expected to produce recommendations for the implementation *of PDCA* that are applicable and in accordance with SPBUN operational conditions, so as to support efficiency improvement, minimize potential losses due to *losses*, and improve the accuracy of stock control and fuel reporting quality in a sustainable manner in the SPBUN operational environment.

Based on this description, the urgency of this research lies in the need for a stock control system that is not only reactive, but also adaptive and sustainable. Without a systematic monitoring mechanism such as *the Plan–Do–Check-Act (PDCA),* potential *losses* in the process

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of receiving and selling fuel risk continuing to recur and cause cumulative losses, both in terms of finance and operational efficiency. Therefore, this research is important to contribute to the development of a more measurable, accurate, and continuous *improvement oriented stock control system* to support the improvement of fuel distribution performance at petrol stations.

2. RESEARCH METHODS

According to (Rijal, 2021), qualitative research aims to understand phenomena in depth through a contextual approach, where the researcher plays a direct role as the main instrument in the process of data collection and interpretation. Through this approach, the data obtained is not only understood numerically, but also analyzed based on meaning, situations, and real conditions that occur in the field.

Therefore, the researcher uses a qualitative research method with a descriptive analysis of case studies in order to describe the condition of fuel losses, stock control practices that are running, and analyze opportunities for the application of the method *Plan–Do–Check–Act* (PDCA) as an effort to improve continuously. PDCA is used as a framework for improvement analysis through continuous stages of planning, implementation, evaluation, and corrective actions (Mekarisce, 2020). This research was carried out at SPBUN as a location relevant to the problem of losses and fuel stock control.

The unit of analysis in this study is the operational process of controlling fuel stocks at petrol stations which includes fuel receipt activities, storage, stock measurement, administrative recording, and internal control mechanisms that have the potential to cause *losses*. Based on (Permadi et al., 2025), the application of the PDCA approach can systematically improve operational efficiency and process quality, so that this unit of analysis is appropriate to be studied as a basis for continuous improvement. The determination of informants is carried out using *purposive sampling*, namely the deliberate selection of informants based on direct involvement and understanding of the fuel stock control process, so that the information obtained is relevant and supports the research analysis. The unit of analysis in this study is the engineering and operational division. by determining several informants including:

Yes	Name	Departments	Long Time Working
1.	ZH	Head of Engineering and Operations Division	11 Years
2.	AP	Staff of the Engineering and Operational Division	10 Years
3.	EN	SPBUN Coordinator	3 Years

The researcher chose informants with different positions because each has a complementary strategic role in the operational management of the SPBUN. The Head of the Engineering and Operational Division was chosen because he has the authority to determine policies and supervise *the standard operating procedure* (SOP) for controlling fuel stocks. The divisional staff was selected because they were directly involved in the process of operational monitoring, checking procedures, and *processing stock and loss* data. Meanwhile, the Chief Operator was chosen because he was the main implementer of daily processes such as receiving, distributing, and measuring fuel stocks. This combination provides a

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comprehensive overview ranging from policy aspects, administrative technical, to field operations.

The informants in this study consisted of three main parties who had direct involvement in the fuel stock control process. The first informant is ZH as the Head of the Engineering and Operational Division, who is responsible for supervision, operational performance evaluation, and decision-making related to technical policies. The second informant is AF as a division staff who plays a role in operational *monitoring*, procedure checking, and collecting and recapitulating fuel data. The third informant is SY as the Head of SPBUN Operator, who is responsible for ensuring that the *receiving*, *dispensing*, and stock measurement process (sounding) runs according to the provisions. Thus, all informants have direct relevance to the focus of the research.

The data collection technique in this study used semi-structured interviews and non-participatory observations. Semi-structured interviews were used to explore informants' knowledge about the fuel stock control work system, potential *loss* points, operational constraints, and views on the possible application of *the Plan–Do–Check–Act (PDCA)* method. Meanwhile, non-participatory observation is carried out by the researcher directly observing the process of receiving fuel, measuring tank stock (*sounding*), recording stocks, and reconciliation processes without being involved in operational activities, so that the data obtained remains objective and describes real conditions in the field.

In addition to interviews and observations, this study is also complemented by document studies as supporting data. The documents analyzed include fuel receipt reports, daily stock measurement records, distribution administration records, operational SOPs, and other supporting documents relevant to stock control. The document study aims to validate the suitability between the data submitted by the informant, the results of field observations, and the administrative evidence owned by the SPBUN. Thus, the data obtained becomes more robust, accurate, and scientifically accountable.

The data analysis technique is carried out through several stages that start from the time the data collection process takes place. The first stage is data reduction, which is the process of selecting and focusing on information relevant to fuel stock control and the potential implementation of *PDCA.* The second stage is the presentation of data in the form of descriptive narratives, thematic tables, and analysis flows. The last stage is the drawing of conclusions which is carried out after the pattern of relationships between findings is clearly read, then re-verified with the informant to match the actual operational conditions.

The validity of the data in this study was obtained through *a member check process* involving key informants to ensure the suitability between the results of the researcher's analysis and the real conditions in the field. In addition, source triangulation is carried out by comparing the results of interviews, observations, and supporting documents so that the data obtained is more valid and reliable. These efforts aim to ensure that the results of the research can be trusted and describe the actual condition of fuel stock control at the SPBUN.

3. RESULTS AND DISCUSSION

RESULTS

This section presents the results of research obtained through field observations, interviews, and analysis of fuel stock documents at SPBUN. The findings were then analyzed to see the pattern of losses, causative factors, and their impact on stock conditions and

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operational control. The next discussion focused on the two main points of loss, namely at the receiving and *dispensing* stages.

1) Conditions and Patterns *of Fuel Losses* at Petrol Stations

Based on the results of observations, interviews, and daily fuel stock documents at petrol stations, it is known that *fuel losses* are the difference between physical stock in the *surface tank* and administrative data from fuel sales and receipt reports. This difference tends to appear repeatedly at the two main points of the process, namely receiving (receiving from suppliers) and *dispensing* (sales through dispensers). The average loss rate is in the range of 0.3–0.5% of the total fuel volume per month, which is still within Pertamina's tolerance limit (maximum 0.5%), but shows fluctuations that need to be controlled more systematically.

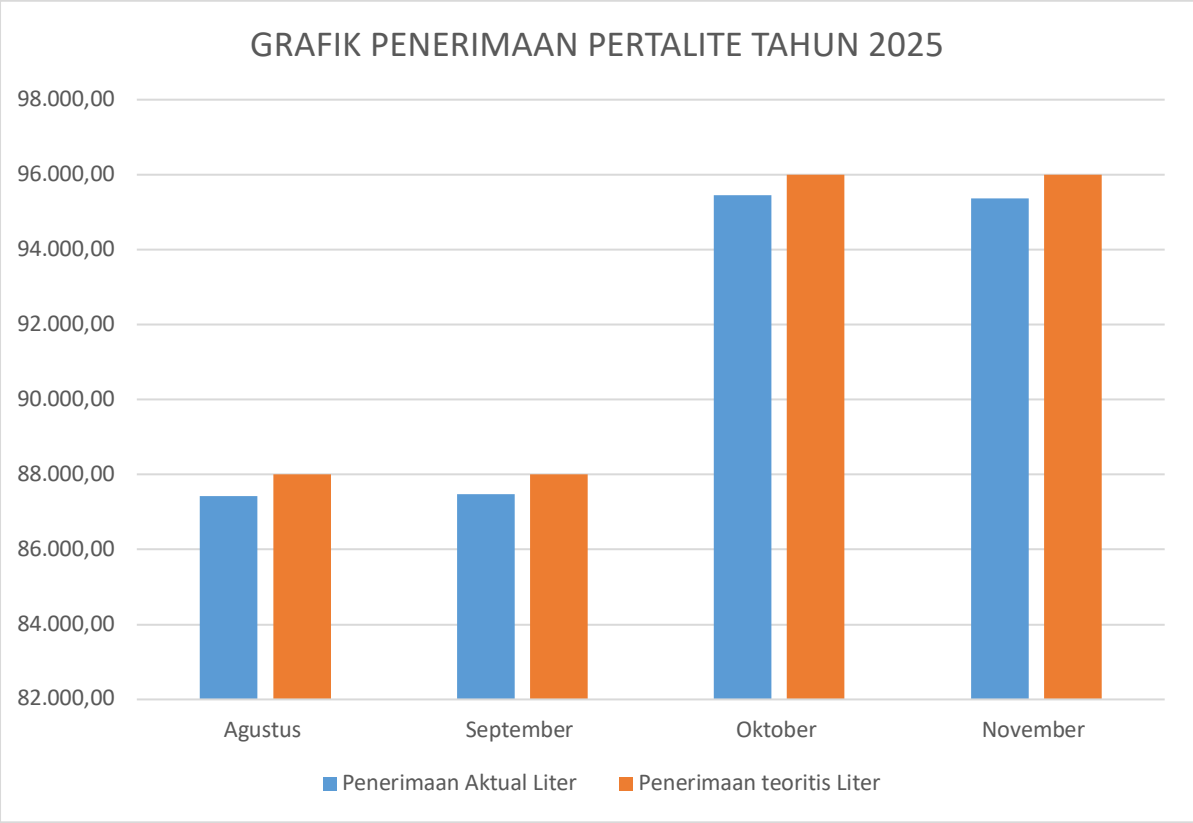

Figure 3. 1 Receipt of Pertalite SPBUN
Source : Data processed from the Company 2025

In figure 4.1 that the author has presented earlier, it can be seen that in the receiving loss process, it appears when the fuel volume listed in the Delivery Order (DO) from Pertamina does not fully match the actual measurement results in the SPBUN storage tank. This condition was strengthened by the statement of the Head of the Engineering and Operational Division, who explained that,

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"The difference in volume is generally in the range of 20 to 30 liters for each delivery. Although on a daily basis this difference seems small, the accumulation of several deliveries in one month makes the difference quite significant in the final report. This shows that *losses* at the receipt stage are cumulative, where small differences that occur repeatedly will form larger differences in the next reporting period."

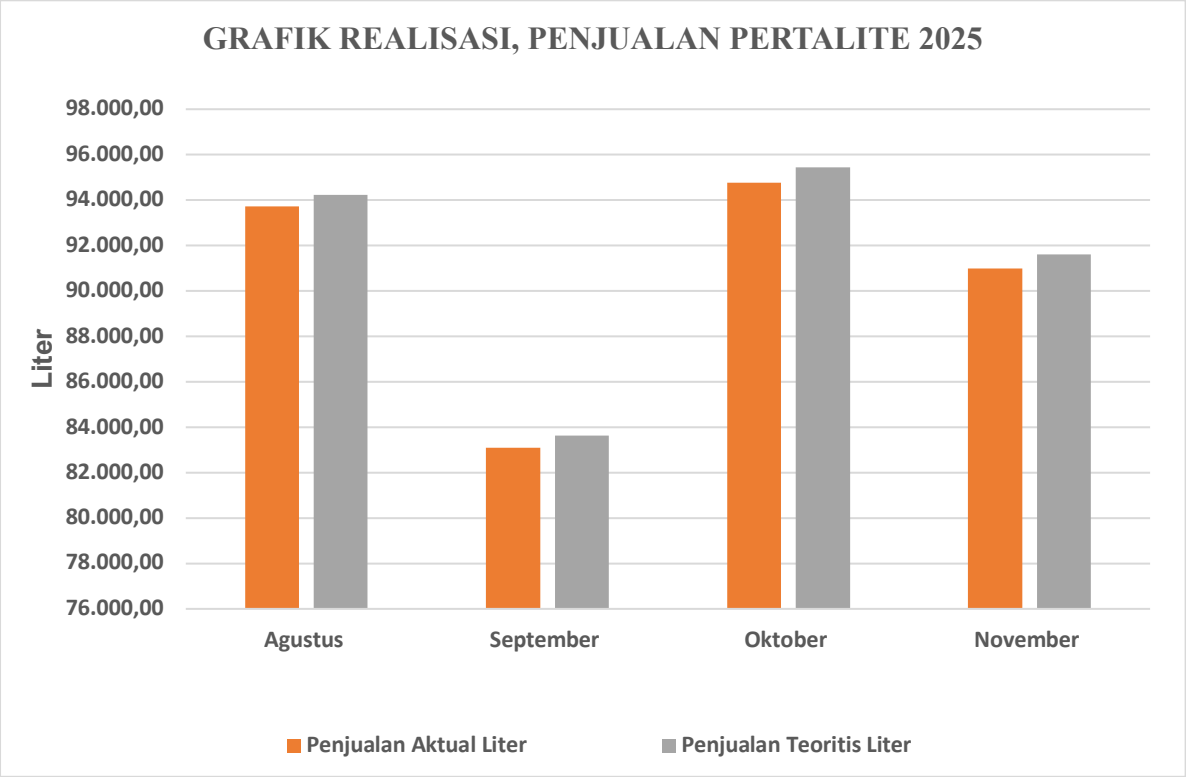

Figure 3. 2 Pertalite Fuel Sales SPBUN
Source : Data processed from the Company in 2025

Meanwhile, in Figure 4.2 that the author has previously presented, the results of pre-research conducted through initial observation and preliminary interviews with the internal parties of SPBUN show that *fuel losses* at the *dispensing* stage tend to occur more often during crowded service periods. Based on interviews with the operational staff of SPBUN, information was obtained that the condition of service density affects the accuracy of filling and recording sales. The operational staff said that,

"During busy service hours, the focus of officers is more on smooth customer service. As a result, the accuracy in recording sales and updating stock data sometimes decreases, so that administrative data does not directly reflect the actual condition of fuel in the tank."

Furthermore, operational staff explained that delays in correcting daily stock data have the potential to cause small differences that continue to accumulate. If these conditions are not followed up immediately, then the initially insignificant difference can develop into *losses* seen in the monthly report.

The findings were strengthened through an interview with the Head of SPBUN Operator, who explained that one of the dominant causes *of losses* also came from the sales

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side, especially related to the accuracy of the dosage on the fuel dispenser. The Chief Operator said that,

"Some dispensers, especially those that have been in operation for a long time, do not always show truly precise volume dispensing results. In the condition of few customers, the difference is not very visible, but when the service is solid, the small difference per transaction becomes quite significant in the final report results."

Based on the results of the interview, it can be concluded that *fuel losses* at the petrol station are not only influenced by technical factors of distribution, but also by administrative aspects, especially related to the accuracy of recording, stock data updates, and consistency in making daily corrections. The insynchronization between physical conditions and administrative data causes differences that are cumulative and appear as *losses* on periodic reports.

2) Identify Factors Causing *Losses*

To identify the cause of *losses*, an analysis was carried out using the 5M (Man, Machine, Method, Material, Measurement) approach. The results of interviews, observations, and studies of operational documents show the following causative factors:

No.	5M Aspect	Factors Causing *Fuel Losses* at SPBUN
1.	*Man*	- The level of accuracy of operators varies when sounding and recording daily stocks. - Lack of discipline in updating stock data after receiving or selling fuel. - Communication between shifts has not been optimal, causing data differences between morning and evening shifts. - There are irresponsible individuals in delivering fuel to petrol stations
2.	*Machine* (Equipment)	- The dispenser is rarely recalibrated, so the measurement is not always accurate between the actual volume and the one recorded on the meter. - Manual measuring sticks start to wear out and don't always produce precise readings. - There are no automatic tools such as automatic tank gauge (ATG) to confirm the results of manual measurements.
3.	*Method*	- SOPs for measuring and recording stock have not been standardized between operators. - The process of receiving fuel from Pertamina has not yet had a joint verification step between tank drivers and petrol station officers.

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		- Stock renewal procedures are still manual, often done after the activity is complete, not during the process.
4.	*Material* (Material)	- Fuel is volatile; The high temperature during daytime delivery causes a difference in volume between Pertamina's DO and the actual sounding results on the surface tank. - The absence of temperature adjustment during volume measurement causes data differences between documents and physical results.
5.	*Measurement*	- The sounding schedule is not yet uniform; Measurements can be taken at different hours between shifts. - There is no digital recording system or automated auditing to detect stock differences in real-time. - Inconsistencies in the sounding technique between operators cause variations in measurement results.

Source : Technical and operational Section discussion with the author (2025)

Based on the results of the identification, it can be concluded that *fuel losses* are caused by a combination of human factors, equipment, and work methods. Thus, the Man, Method, and Machine factors are the three most dominant main causes, because they have a direct effect on the accuracy of measurement and the accuracy of recording fuel stocks.

And based on the results of the interview, information was obtained that the source of the difference or *losses* could come from various factors. From the technical side, volume differences can arise due to the operator's inaccuracy in taking measurements or equipment conditions that are no longer optimal, such as sounding sticks that change shape resulting in a difference in measurement of several liters. In addition, even though SPBUN already has Standard Operating Procedures (SOPs), its implementation has not been completely consistent in the field. There are variations in practices between operators, such as differences in the sequence between the sounding process and data recording, which results in measurement results not always being uniform. In terms of operational equipment, the accuracy of dispensers—especially older dispensers—is also a contributing factor, because meter changes that should be calibrated regularly are often only made when the difference is large enough due to busy operational activities.

3) Implementation of PDCA as a Corrective Approach

The *Plan–Do–Check–Act* (PDCA) method is used as a *continuous improvement* framework to reduce *fuel losses* and improve stock accuracy at petrol stations. The stages of PDCA are implemented as follows:

A. *Plan*

At this stage, problem mapping is carried out based on the results of previous analysis. The main focus of the improvement plan is:

1. Improve the accuracy and discipline of operators in measurement and recording.
2. Develop new SOPs for stock measurement and verification between shifts.

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3. Establish regular dispenser calibration schedules and *inspections of sounding* devices.

At this planning stage, the management also designed a daily checking system as a form of strengthening internal control. The system aims to ensure that the measurement results (sounding) on each shift are not reported immediately, but are first verified by other officers before being sent as an official report. With this verification mechanism, it is hoped that the potential for measurement errors and data mismatches can be minimized from the beginning so that the accuracy of stock data is better maintained.

B. Do (Implementation)

This stage includes a trial of implementing improvement steps:

1. Using the stock verification checklist form between shifts.
2. Re-measurement after unloading the fuel to ensure the conformity of the DO with the sounding results.
3. Perform an initial calibration of the old dispenser as a test.

At the implementation stage, the operational team began to implement the control mechanism that had been planned. One of the steps taken is the use of a checklist form that contains the sounding results of each shift, so that stock data between morning and afternoon shifts can be directly compared in one document. In this way, if there is a difference in measurement results, the discrepancy can be detected immediately and clarified on the same day, so that the potential for a larger difference can be minimized.

C. *Check* (Examination/Evaluation)

At this stage, an evaluation of the test results is carried out:

1. *Daily* and monthly losses compared to data before the implementation of PDCA.
2. Checked the consistency of recording between shifts.
3. It is observed whether the frequency of the DO–stock difference decreases.

At the examination stage, an evaluation was carried out on the results of the trial of the implementation of the corrective steps that had been carried out. The evaluation focused on the comparison of daily and monthly losses before and after the implementation of the system, the consistency of recording between shifts, and the tendency to decrease the frequency of the difference between DO data and actual stock. Based on the results of the initial evaluation, the implementation of new registration forms and daily checking mechanisms make potential discrepancies can be detected faster. If previously the difference was often only seen at the end of the reporting period, then with a new system the difference can be known early so that it can be followed up immediately.

D. *Act* (Follow-up/Standardization)

Measures that have proven effective are standardized into new operational standards:

1. SOPs for stock measurement and recording were rearranged and socialized.
2. The dispenser calibration schedule is set at least every three months.
3. Operator training is held to ensure uniformity of *sounding techniques*.

In the follow-up stage, the improvement measures that have proven effective are then standardized into new operational standards so that they can be applied consistently. The

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rearrangement of SOPs for measuring and recording stock is accompanied by the establishment of periodic dispenser calibration schedules, as well as operator training to ensure uniformity of sounding techniques. In addition, management also plans to standardize the evaluation system through the preparation of *an official loss* recap on a regular basis, so that the results of control can continue to be monitored and used as material for continuous evaluation.

DISCUSSION

1. *Fuel Losses* at Petrol Stations as Cumulative Inventory Variance

The results of the author's research show that *losses* Fuel at petrol stations is not a single incident, but a form of *Inventory Variance* which is accumulative. Small differences that appear in the process *receiving* (between volumes *Delivery Order* with the measurement results *Surface Tank*) and *Dispensing* (the difference in dispenser dosage when demand increases) if not corrected every day will accumulate into a monthly loss.

These findings are in line with the theory *Fuel Inventory Variance* in the stock control system which states that the difference between physical stock and administrative stock is a form of *variance* that needs to be handled systematically (Hasanain & Mahachandra, 2025). The manual fuel stock recording system often causes data differences between administrative stocks and real conditions in the field. This results in reporting errors and decreased operational efficiency.

Thus, the author's research reinforces the concept that *losses* Fuel is a *accumulative variance* which is rooted in poor daily control. Stock control that is only reactive (after losses arise) causes data mismatches to continue to be repeated and has a direct impact on the operational efficiency of SPBUNs.

2. Factors Causing *Losses* and Their Relationship to the 5M Theory

Analysis using the 5M approach (*Man, Method, Machine, Material, Measurement*) indicates that the main causative factors *losses* Fuel at SPBUN is *Man* (Human), *Method* (working method), and *Machine* (equipment). The human factor includes the operator's precision when performing *Sounding* and stock recording discipline. Method factors related to SOPs that are not uniform between *Shift* and there is no verification system for measurement results. Meanwhile, the equipment factor concerns the accuracy of the dispenser and *Sounding Stick* which is rarely calibrated. These findings are in line with research by (Karmila & Lukman, 2023) at PT Pertamina Fuel Terminal Jambi, which found that *Working Loss* The highest in Pertamax Turbo products occurs due to high temperatures, operator errors, and manual systems that are not calibrated regularly.

Research (Wijaya et al., 2023), also corroborated that cash and stock management at petrol stations that are still manual increases the risk of inventory depreciation exceeding the 0.5% tolerance limit. Thus, the author's research results confirm the literature that *losses* BBM is not only caused by technical factors, but also weaknesses in procedures and operator behavior that is not disciplined to SOPs. The consistency between the field findings and the 5M theory shows that problem solving *losses* BBM must be systemic in nature, including improving human resource competence, standardizing work procedures, and calibrating measuring instruments periodically.

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3. The Relevance of the Implementation of PDCA as a Process Improvement Strategy

Method application *Plan–Do–Check–Act* (PDCA) at SPBUN is positioned as an approach *Continuous improvement* to strengthen stock surveillance and suppress the occurrence of *losses* fuel that is accumulative. PDCA is used because it is able to change the control pattern from initially tending to be reactive (waiting for a monthly recap) to more proactive control through daily control, intershift verification, and standardization of work procedures.

A. *Plan*

At the stage *Plan*, mapping out the main problems *losses* that appear most often in the process *receiving* and *Dispensing*. Mapping is carried out by examining the difference in volume between *Delivery Order* (DO) and tank measurement results (*Surface Tank*) at the time of receipt, as well as identifying potential causes of discrepancies in distribution such as inaccuracies in dispenser measurements and delays in updating administrative stocks. Based on the mapping, planning is directed at the preparation of improvement steps that target the root of the dominant problem, namely increasing operator accuracy, strengthening verification, and improving tool reliability. Improvement plans include:

1. Preparation of daily stock verification form format between *shifts*
2. Determination of post-receiving remeasurement mechanism to ensure the conformity of DO with *the sounding results*
3. Dispenser calibration scheduling and checking the condition of the measuring instrument (*sounding stick*)
4. Preparation of strengthening SOPs for measurement and recording so that they are uniform.

This Plan stage is carried out so that petrol stations have a control plan that is based on real field problems and is able to prevent small differences from developing into monthly losses.

B. *DO (*Implementation*)*

At the Do stage, SPBUN carries out a trial of the repair plan that has been prepared. The implementation is carried out by starting using a stock verification form between shifts so that the results of measurements (sounding) and stock records from the morning and afternoon shifts can be recorded in the same format and can be compared on the same day.

In addition, in the fuel receipt process, re-measurements are carried out after dismantling as a verification step to minimize the potential difference between DO and tank measurement results. On the process *Dispensing*, the first step of repair is carried out through the initial inspection and calibration of the dispenser, especially for dispensers that have been used for a long time, in order to reduce the chance of inaccuracy of the dosage that can accumulate during rush hour.

This Do stage aims to ensure that the improvement plan does not stop at the concept level, but can be tested operationally so that the impact on stock supervision and *losses* can be seen.

C. *Check (*Examination/Evaluation*)*

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The Check stage is carried out to evaluate the effectiveness of the implementation of improvements. The evaluation was carried out by comparing the conditions before and after the implementation of daily control, especially in terms of the speed of differential detection and consistency of recording between shifts. SPBUN reviewed whether the verification form helped speed up the finding of daily stock differences, as well as whether the difference in receiving (DO vs sounding results) was identified more quickly on the same day.

In addition, checks are carried out on the consistency of administrative stock updates so that there are no recording gaps that magnify the difference between physical stock and recorded stock. This Check stage is important because it is the basis for assessing whether the corrective actions implemented are really reducing losses, or still require further adjustments. With periodic checks, SPBUN can avoid conditions where the difference is only visible at the end of the month, because the difference has been detected since the day.

*D. Act (*Follow-up/Standardization*)*

At the Act stage, measures that have proven effective in trials are standardized into working standards. Standardization is carried out through the preparation or revision of SOPs for measurement and stock recording, including the determination of the use of verification forms as part of daily procedures. In addition, a periodic dispenser calibration schedule is set and the condition of the measuring equipment is checked to ensure that measurement accuracy is maintained. In order for the implementation to run consistently, socialization and strengthening of operator discipline is carried out through briefings or brief training on uniform sounding techniques and recording procedures in accordance with SOPs.

On the supervision side, SPBUN can also set an evaluation recap *losses* periodically as a management follow-up material. This Act stage aims to ensure that successful repairs are not temporary, but become standardized work habits so that they are able to maintain stock accuracy and reduce *losses* on an ongoing basis.

Overall, the author's research results show that *losses* Fuel at SPBUN is accumulative, caused by a combination of human factors, methods, and equipment, and can be controlled through the implementation of PDCA as a continuous improvement cycle. The integration of operational management theory, TQM, and PDCA explains that organizations that implement systematic control and repetitive evaluation will be able to reduce stock variance, improve report accuracy, and increase operational cost efficiency.

4. CONCLUSION

Based on the results of the research and discussions that have been carried out regarding the analysis of the potential application of the Plan-Do-Check-Act method to reduce fuel oil losses at petrol stations, it can be concluded that *the fuel losses* that occur are cumulative and are a form of inventory variance. The difference between physical stock and administrative stock does not occur individually, but arises from small differences that occur repeatedly in the process of receiving fuel oil from Pertamina and in the distribution process through dispensers. Inconsistencies in making daily corrections cause the discrepancy to accumulate

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and have an impact on the monthly report. This condition shows that the running stock control system still tends to be reactive and relies heavily on manual recording.

The results of the analysis using the 5M approach show that the causes *of fuel losses* at petrol stations are dominated by human, method, and machine factors. Human factors are related to the level of accuracy and discipline of the operator in carrying out stock measurements using sounding and in administrative recording. The method factor is shown by the inconsistency in the implementation of standard operating procedures between work shifts, as well as the weak mechanism for verifying the results of stock measurements. Meanwhile, the engine factor is related to the condition of the dispenser and measuring instruments that are rarely calibrated periodically. The combination of these three factors is the main cause of *recurring and cumulative fuel* losses.

The application of the Plan–Do–Check-Act method has the potential to be effective in reducing *fuel losses* through the sustainable strengthening of the stock control system. In the planning stage, companies can map the root cause of losses and design data-driven improvement plans. The implementation stage is carried out through trial improvements, such as the implementation of stock verification forms between shifts and the implementation of calibration of measuring instruments. Next, the examination stage is carried out to evaluate the effectiveness of the corrective actions that have been implemented. At the advanced action stage, the corrective measures that have proven to be effective are standardized into the standard operating procedures. This PDCA cycle is able to change the control system that was originally reactive to more proactive, with more consistent and measurable daily stock monitoring.

Overall, the integration of operational management theory, Total Quality Management, and Plan–Do–Check–Act methods supports increased operational efficiency at SPBUN. The implementation of PDCA is in line with the principles of TQM which emphasizes the importance of human resource involvement, standardization of work processes, and continuous evaluation to achieve performance improvement. Thus, the PDCA method can be used as the right managerial tool for SPBUNs in building a quality-based stock control system, reducing stock variance, increasing reporting accuracy, and increasing operational cost efficiency in a sustainable manner.

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