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LOSS PREVENTION OF FUEL TERMINAL OPERATIONS: A CASE STUDY IN TURKEY

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Abstract: Upon exiting the refinery, fuel products are distributed to vessels, from vessels to the terminals conducting the activities of fuel storage and distribution operations, and from terminals to stations via road tanker. Problems of loss in the product quantities occur after the movements of displacement of the product in terminal tanks and simultaneous the movements during filling operations. In this paper all operation processes of one of the fuel oil terminal in Turkey. The fuel products were received upon the unloading of the vessel and storage and distribution activities were carried out in this terminal. The elements causing loss during the terminal operation processes were examined with the failure modes and effects analysis (FMEA) technique. According to this analysis, the fields for which measures would be taken with precedence and a solution approach were presented for the company. While this approach is providing the causes of occurrence of failures as well as the control of loss for the company, the risk of fire and spillage likely to occur can be prevented as well.

Key words: Loss prevention, fuel terminal, FMEA

AKARYAKIT TERMİNALİ OPERASYONLARINDA KAYIPLARIN ÖNLENMESİ: TÜRKİYE'DE BİR VAKA ÇALIŞMASI

Öz: Rafineriden çıktıktan sonra, akaryakıt ürünleri gemilere, gemilerden yakıt depolama ve dağıtım operasyonlarını yürüten terminallere ve terminallerden istasyonlara kara tankerleri ile dağıtılır. Ürün miktarındaki kayıp problemleri, ürünün terminal tanklarında yer değiştirmesi ve aynı zamanda doldurma işlemleri sırasındaki hareketleri sonrasında ortaya çıkar. Bu çalışmada Türkiye'deki en büyük akaryakıt terminallerinden birine ait tüm operasyon süreçleri ele alındı ve bu terminalde depolama, dağıtım aktarma faaliyetleri ve bu sırada oluşan kayıplar incelendi. Terminal operasyon süreçlerinde kayba neden olan elemanlar, hata modu ve etki analizi (FMEA) tekniği ile incelenmiştir. Bu analize göre, önlemlerin öncelikli olarak alınacağı alanlar ve çözüm yaklaşımı firmaya sunulmuştur. Bu yaklaşım, arızaların oluşmasının nedenlerini ve aynı zamanda şirketin zararını kontrol etmeyi sağlarken, yangın ve dökülme gibi risklerin önlenebileceği tedbirler ortaya çıkarmıştır.

Anahtar Kelimeler: Kayıpların önlenmesi, akaryakıt terminali, hata modu ve etkileri analizi(HMEA).

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1. INTRODUCTION

Terminals are generally divided into dry load, container, Ro-Ro, liquid load and bulk load terminal. In the operation of liquid load terminals, safety precautions have a higher priority than other terminal types. The cargo may be flammable, explosive, volatile or very expensive. For this reason, it is necessary to take precautions to detect leaks or leaks. Fuel terminals, which are one of the most frequently transported liquid freight, must also follow procedures in line with the rules laid down by the state at the same time. For this reason, the problems and operations of the fuel terminals are similar in many respects to container terminals and port management, but they differ in terms of performance criteria due to the regulations that the government imposes. The most important difference is that the amount of incoming and outgoing goods is also controlled by the state. In this study, operations in a special fuel terminal operating in Turkey were examined in terms of quantity. On the one hand final energy consumptions shows that the fuel is the most consumed product of Turkey (Yüksel, 2010, Evrendilek et al. 2003) but on the other hand Turkey has storage problem for fuel. It is obliged to hold minimum oil stocks equivalent to 90 days of annual consumption in accordance with requirements of the International Energy Agency (IEA)(EPDK,2014).

Recent oil price increases, companies have used their oil stocks to compensate, and oil stocks are currently below required levels (Balat, 2010). Inventory management is one of the most important activities of a fuel company, and it should be intended to keep the inventory within the limits through the checks performed every day, every week, and every month. In the event of failure to check the inventory well, the available capacity will be exceeded and product losses and problems will be experienced. Good inventory management should be performed in order for loss to be kept within the limits at A. Ltd. Company which studied in this paper. In the event of failure to check the inventory well, both it remains outside the limits and the exceeding of the available capacity might bring about problems of risks of spillage and fire.

The failures and factors underlying the origins of loss pertaining to the operations at A. Ltd. Terminal were investigated; the sizes of the effects resulting from their being outside the limits were assessed; and an evaluation was made concerning the negative effects to be caused by them. The amounts of loss in the available resources, being of great importance for the operation of A. Ltd., have an essential place in the determination of the confidence relationship between the establishment and the state.

All the activities which begin with discovering – during the calculations performed after intra-terminal product transfers, daily reconciliation or any inventory movement – that the limits specified by the company have been exceeded and which encompass the causes of this and the measures to avoid the recurrence of this constitute loss management. The losses that occur here result in both operational failure of the operator and sanctions imposed by the state.

For that reason this study covers for the failure modes and effects analysis of the loss checks in the operations of the fuel storage and distribution terminal. The operation processes were examined in detail and the operations of vessel-terminal storage tanks, the transfer operations carried out in the terminal storage tanks, the transfer operations carried out with the neighboring terminals and the storage tank-road tanker filling operation processes were checked on the basis of the operations at A. Ltd. Terminal, located on the European side of Istanbul and storing and distributing fuel. The instructions, standard practices and procedures of A. Ltd. Company, the legislations of the Energy Market Regulatory Authority (EPDK), the Directorate for Science, Industry, and Technology, the Scientific and Technological Research Council of Turkey (Tubitak), the Ministry of Customs and Trade, the Directorate General for Customs Enforcement, and other official institutions and organizations and the legal limits were taken into consideration during the examination and checking of the origins of loss pertaining to the operation processes.

The measures required to be taken in emergencies and the risks at fuel storage stations are examined in many studies (Ravi et al 2015, Argyropoulo et al 2012. Mingzhu et al. 2016). Such methods as the SWOT analysis approach and risk prioritization are widely used in these analyses (Arslan et al. 2008). Safety and prevention of losses will also help with the prevention of cases like leakage that particularly cause such accidents as fire and explosion in tanks (Arslan et al. 2008, Ravi et al 2015).

2. A FUEL STORAGE AND DISTRIBUTION TERMINAL OPERATIONS

A. Ltd. Company., a fuel storage and distribution terminal, carries out the storage activity by unloading the fuel products coming from within the country and abroad via the vessels of the partner establishments, to which it is affiliated, into the fuel storage tanks located at the terminal site. Terminals can make their sale by transferring the fuel products which come from within the country and are stored to the other neighboring storage terminals by means of pipelines. By carrying out an operation of filling the road tanker, it can make sales of products to the fuel stations of partner companies and to the storage tanks at airports. In addition, it can carry on the activities to ensure that the product has the limit values at which it should be allowed to be sold within the national boundaries with the national marker fluid provided by Tubitak after the payment of the taxes of the fuel products coming from abroad. During all these activities, loss in the quantities of the products might take place depending on the displacement of the fuel products.

As it seen in figure1. the flow diagram of the fuel storage and distribution terminal is presented, and depending on this, the operation processes can be stated as follows:

a. Vessel unloading and loading operations
b. Road tanker filling & sales operations
c. Pipeline operations
d. National marker operations

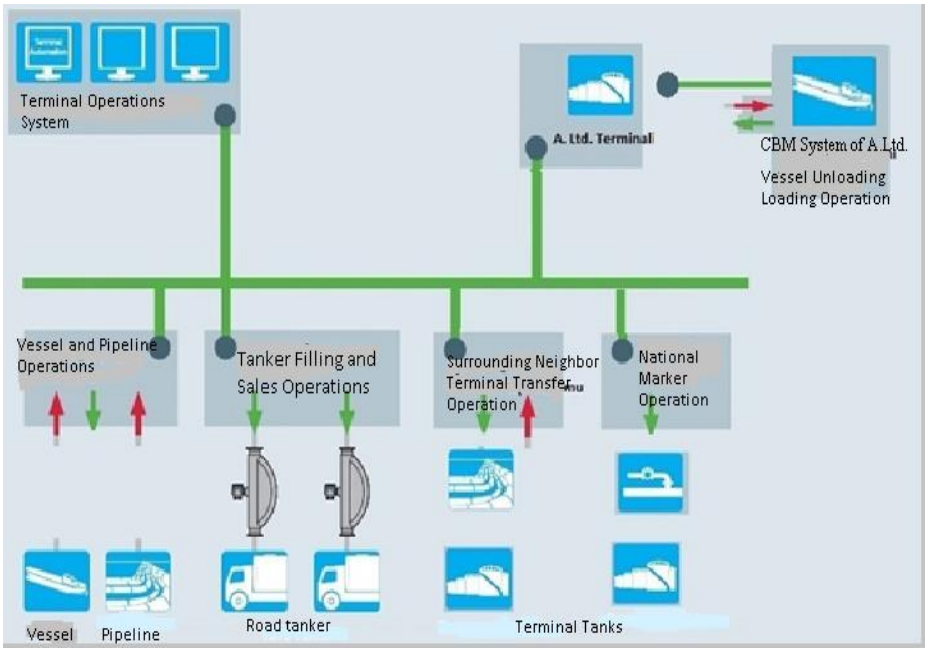

***Figure 1**:*
The workflow of the fuel terminal

2.1. Vessel unloading and loading operations

The fuel storage terminals with no pipeline connection with the refinery from the land must receive their products by vessels in order to carry on their activities, and this definition is called vessel unloading. Both vessels can unload products to terminals and a vessel can be loaded with fuel by the terminal. The activities carried out for the optimum and the safest performance of fuel operations by the vessels which dock into the terminal either to unload the products they have been loaded with or to load products into empty cargo tanks are called vessel unloading and loading operations. To determine the full and empty conditions of vessels before the unloading and loading operations they will perform at the terminal, with how much missing or excess product they have arrived is checked before unloading; the vessel party and the terminal party again check these quantities after unloading; and loss are calculated depending on the changes in the product volumes. As a result of the documents demanded from the tanker and checked, with how much loss the vessel has initially arrived, whether the incoming product conforms to the criteria and which products it will unload according to which order are reviewed and a protest about those which do not conform is drawn up and signed mutually with the shipmaster. At the beginning of unloading, attention is paid to what has remained in the line after the previous unloading/transfer. If it is water which has remained in this line, problems of loss may be experienced in gauging, whereas if it is another product which has remained in this line, problems of quality due to the mixing of products may arise.

2.2. Road tanker filling & sales operations

They encompass the operations of loading the products into the road tanker from the storage tanks by means of pipelines so as to convey the fuel products stored at the terminal to the end consumer. The products loaded into the road tanker are transported to airports, stations, and the areas in which they will be used. Before selling the product to the land tanker, the product quantity in the terminal tanks is gauged; it is checked whether the road tanker is empty; and it is important that the equipment, product meters and digital valves used during the sales function properly. The losses of the steam coming out from the open lid on the tanker, the calibration values of the meter, air temperatures, operation of the digital valves and the flow rate of the pump are essential for loss during the operations of filling the tanker. Road tanker filling operations are comprised of all activities conducted in order for terminals to convey their products to stations, airports, and other establishments which will convey them to the end consumer.

2.3. Pipeline operations

Fuel pipeline operations can be categorized as follows:

- Inter-terminal transfer operations
- Transfer operations between the tanks within the terminal (Neighbor Terminal Operations)
- Drainage operations

For inter – terminal operations;

Acoording to terminal operations plan, terminal should decide to transfer the product from tank to tank. These operations is sometimes could be obligation before the other operations. For instance; if the terminal has an operation from the vessel or etc. and If the related tank capacity is not enough approximetly 50-60m³, terminal can transfer the product another tank. And with this action vessel should discharce the product only a tank, instead of two tanks.

If terminal has a maintenance plan in a tank, terminal should decide to transfer the product to another tank. Also; national marker operation should appraisable at internal operation.

For Neighbor Terminal Operations;

Terminal has a capability to have an operations between neighbour terminals. With this relation, terminal can transfer the product to another terminal, can receive the product from

another terminal, can discharge the product from another terminal. These flexible actions are always provides a chance not being stock – out.

For drain operations;

If the terminal has the product from the CBM system, terminal obliged to clean the pipe line with the water. After finishing the operations, terminal must seperate the related tanks water and tis is called drain operations. The main action is to separate the product and water with gravity.

Besides the opening and closing measurements pertaining to the tanks, temperature, gauging and density values affect all these types of operations and everything is recorded via the reports by supervisors. The product quantity in the tanks must be calculated; the product quantity in the tank located at the neighbouring terminal where the operation will be carried out must be checked; and the same calculations must be renewed at the end of all operations.

2.4. National marker operations

As of January 1, 2007, it was required to add a national marker to the national (the tax of which has been paid) fuel products of diesel oil and gasoline derivatives sold within the boundaries of the Republic of Turkey. National Marker operations are activities that terminals implement in order to domestically sell the products they have imported from abroad after they have completed the legal procedures for them. The products which turn out appropriate after this marking operation are considered suitable for being sold domestically; otherwise, it is probable that they will be described as contraband fuel.

The national marker operation is possible through the injection of the national marker product provided by Tubitak into the product – brought from abroad and stored in the transit tank – at the calculated quantity during its transfer in a tank which is ready for sales domestically. The amount of national marker required to be available in fuel products is 8 ppm. It has been made obligatory that the acceptable concentration percentage required to be available in the product has to be in the range 97-108%.

3. PROBLEM STATEMENT: LOSS CHECKS AND ORIGINS OF LOSS AT THE FUEL TERMINAL

The greatest and most active asset of Fuel Storage and Distribution companies is their inventory. In case of an increase or a fluctuation, this asset may provide an incredible amount of financial contribution. Accuracy of inventory records at Fuel Storage Terminals is one of the most important factors for the stability of the company and for the efficient use and management of its resources. Inventory management is vital for the efficient realization of purchasing and selling of the product – the main subject of activity for the company. The efficient and timely realization of supply planning, determination of the total products which are ready for sales and determination of the quantity of the product sold or of physical or record differences can be realized thanks to inventory management.

Basically origins of loss during the fuel operations can be seen in figure 2. as refinery, fuel station, road tanker and fuel terminal. Upon the unloading of fuel from the vessel, tank site activities, transfer activities, marking activities, sales activities, and storage activities and under the external climatic conditions, the losses in the available products resulting from operational activities can be referred to as wastage and the resultant gains as excess. Origins of loss may be divided into 2 as controllable and uncontrollable losses and result from the following operations in the Table 1.

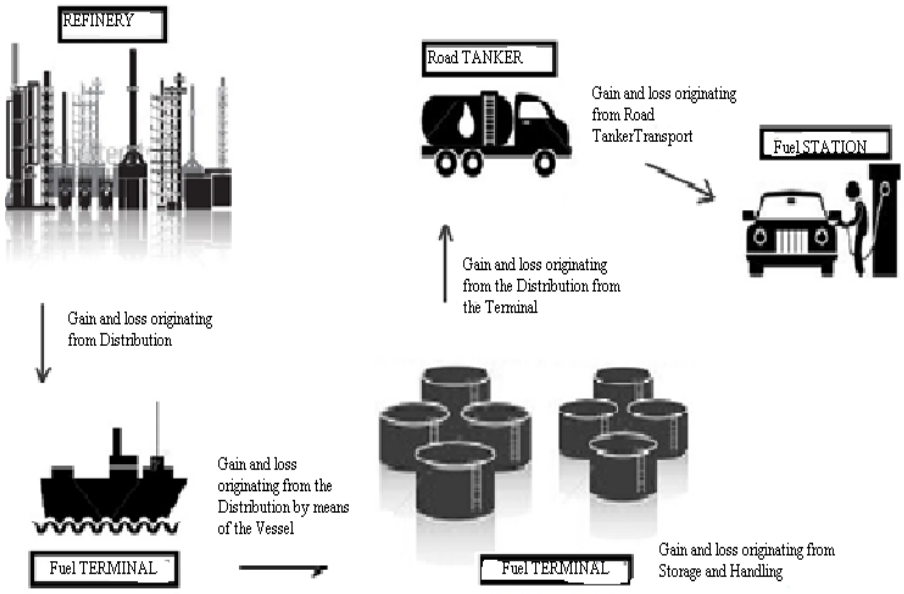

Figure 2:
Origins of loss for fuel operations

Table 1. **Origins of loss**

Controllable Losses	Uncontrollable Losses
Losses due to excessive or inadequate filling	Classes and kinds of products
Spill and leakages	Losses experienced due to displacement of the product
Inaccurate calculations on the document	The fact that the tanks and equipment have recently been put into service
Broken automatic tank gauging systems	Cleaning of the tanks except maintenance
Malfunction Erroneous temperature gauging	Operations involving water
Malfunction Erroneous manual gauging	
Damaged internal floating roofs and equipment	
Wrong vapour recovery equipment	
Nozzles and equipment on the roof of the tank	
Embezzle	
Misdirected operations	
Change in environmental conditions	

The losses arising from sea with Coal bed methane *(*CBM) system and pipeline transport are not within the scope of this manuscript. Under the company principles and the legal obligations, the volume of the product at 15°C (net volume) is used in the inventory calculations.

4. FAILURE MODES AND EFFECTS ANALYSIS FOR CONTROLLING AND PREVENTION OF LOSSES

The failure modes and effects analysis technique is employed to reach the origins of loss at the fuel storage and distribution terminal, to retrace the existing problems, to eliminate the

shortcomings, and to remain within the limits of loss tolerances. With this technique, the definition of the operation is specified; the causes of, and measures against, loss for the operation process concerned, the effect of the reasons for loss and the results are listed; and an application analysis is prepared accordingly. Here the origin of loss occurring as a result of the operation analysis can be seen clearly, and measures can be taken with the necessary barrier in order to avoid reaching unwelcome consequences. The failures of each operation process and their effects are analyzed by making the same analysis for all operation processes. Type of products are Motorin(Diesel), Fuel (Gasoline) and Jet A1.

4.1. A failure mode and effects analysis for the loss originating from vessel operations

Loss may occur at fuel storage and distribution terminals due to such factors as unloading of vessels; automatic tank gauging equipment in the products loaded into/from the vessel, calibrations of terminal tanks, calibrations of vessel tanks, and environmental conditions during loading operations; involuntary spillage likely to occur during the operation; the filters found in the transmission line and equipment; abuse; and the operation speed. These origins of loss might be called the failures and causes of vessel unloading and loading operations. The amounts of this loss can be found by comparing the calculations to be made before unloading and the calculations to be made after unloading. The loss differences occurring in between both can be specified in the respective procedures and instructions of companies and have been limited with the customs regulation introduced by the state for the imported products referred to as transit products. To prevent the failures experienced in vessel unloading and loading operations, some proactive measures should be taken and the effects of failures should be either minimized or intended to be eliminated. The better these measures and barriers are controlled, the more efficient the decrease in the effects of failures will be.

As in the example provided figure 3. regarding the failure modes and effects analysis prepared for vessel operations, it was intended to prevent the origins of loss by means of the specified barriers and it was aimed to stop each factor. In the event of failure of these control measures, loss may occur, resulting in unwelcome consequences.

4.2. A failure modes and effects analysis for the loss originating from road tankerfilling operations

The wastage in a tank can be described as the difference between the quantity coming from the tank within the period when the tank remains in sale and the report on sales the quantity filled. This difference is tracked daily, and the quantities are recorded in the computer on a daily basis. The total loss occurring at the end of the month is distributed according to companies' rates of sales the quantity filled. Loss may occur at fuel storage and distribution terminals due to such factors as the automatic gauging system, calibrations of terminal tanks, meter calibrations, environmental conditions, spillage of products and the additive system, and inaccurate calculations during the road tanker filling and sales operations and the filter problems, abuse, and filling rate during the product transfer. These origins of loss may be called the failures and causes of road tanker filling and sales operations. After the amounts of loss have been found by checking the empty compartments of land tankers before filling, the quantities of the products available in the terminal tanks are determined. The loss differences experienced here both can be determined in the respective procedures and instructions of companies and have been limited by the regulations introduced by the state. To prevent the failures experienced in the road tanker filling and sales operations, some proactive measures should be taken and the effects of failures should be either minimized or intended to be eliminated. The better these measures and barriers are controlled, the more efficient the decrease in the effects of failures will be.

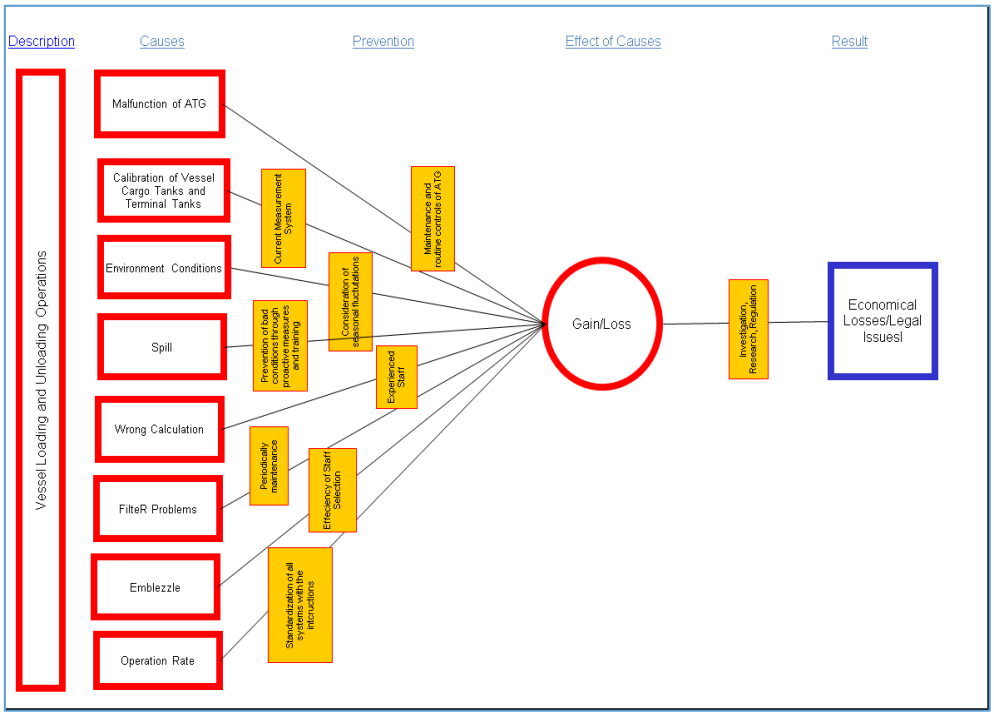

Figure 3:
An application of the failure modes and effects analysis for vessel unloading and loading operations

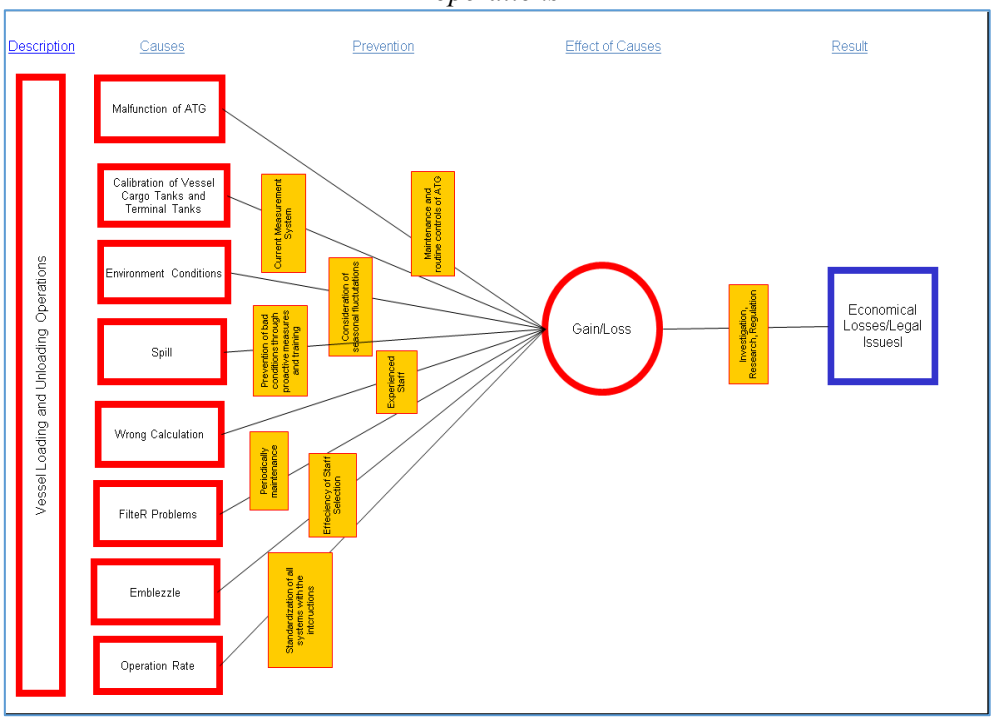

Figure 4:
An application of the failure modes and effects analysis for road tanker filling and sales operations

As in the example provided figure 4. regarding the failure modes and effects analysis prepared for the road tanker filling and sales operations, it was intended to prevent the origins of

loss with the specified barriers and it was aimed to stop each factor. In the event of failure of these control measures, loss will occur, resulting in unwelcome consequences. The FMEA risk analysis shown in Table 2 reveals that multifuction of ATG , environment Conditions, spilling and filter problems are the primary cause of loss in this terminal.

Table 2. FMEA analysis results

	Detectability of Failure (D)	Frequency of occurance (O)	Severity of failure effects (S)	Risk Priority Number =DxSxO
Multifuction of ATG	2	6	7	**84**
Calibration	2	5	6	**60**
Environment Conditions	8	5	3	**120**
Spill	2	7	7	**98**
Wrong Calculation	3	3	7	**63**
Filter Problems	3	6	5	**90**
Emblezzle	10	1	3	**30**
Operation Rate	4	5	3	**60**

4.3. Reasons for failures in the fuel terminal operations

Grouping the reasons for the failures occurring in the fuel terminal operations as a result of the analyses as follows will cast light on the solution and the measures likely to be taken. Nevertheless, the loss tolerances should be taken under control in conformity with the legal legislations with precedence for fuel storage and distribution terminals. Apart from the legal legislations, it is likely that terminals specify a level for themselves which is below the limit values in the legal legislation, as required by their company policies. These loss tolerances entail daily reconciliation, weekly reconciliation, and monthly and yearly checks. The limits and main factors of the elements of loss for the operations have been indicated in the table 3.

Table 3. Factors and limits of loss

Elements of Loss	Limits
Meter Reconciliation	± 4, “the smallest meter movement”, per meter and for the period of reconciliation
Tank and Product Reconciliation – Main Products	Monthly: ≤ ± 0.2% Daily: ≤ ± 0.3%
Tank and Product Reconciliation	Monthly: ≤ ± 10% Daily: ≤ ± 15%

Evaporative losses: They are more significant in the sense of the large amount of losses for gasoline and other high steam pressure products. The following are the factors which give rise to steam losses: displacement of the product, manual gauging/sample collection, and defective gaskets and equipment.

Losses due to filling: During the activities of filling land tankers from the top that are performed to be open to the atmosphere, especially gasoline derivatives will lead to losses due

to their volatile properties. These losses will have been minimized upon the activities of the operation of filling from the bottom that also aim to eliminate the problems of air emission.

Spilling and dribbling/leakage: Spillage due to the loading arm; spillage at filling sites or in other areas due to corrosion, expansion or broken equipment; leakages in tanks; leakages stemming from the defects on the tank floors; or leakages in the pipe flanges.

Abuse: Loss of product experienced due to theft or unauthorized use.

Losses based on temperature changes: There may be temperature-based losses or gains when the inventory is gauged at the ambient temperature. The inventory should be counted at a standard temperature (15°C).

Pipe drainage: For an operational reason, the pipes may be kept empty or full between product transfers.

Tank and filter cleaning: Losses may occur while cleaning the tanks and the filters. It should be intended to gain as many products as possible through drainage before the initiation of the cleaning activities. Furthermore, the cleaning of filters found in the pumps and in the specified areas will contribute to avoiding the calculation of inaccurate product quantities in the system.

Water drainage before and after the receipt of the product to the tank: Especially the fuel storage terminals with a float cause water to mix with the product by pushing the product which remains in the line with sea water by means of the vessel in order to ensure that no product has remained in the pipelines located in the sea. Water should be checked in the tank before such operations performed with water; furthermore, it should be separated from the product carefully when the operation is over.

Losses due to the movement of the product: When a product is carried in mass from one tank to another, the loss of product due to the remaining of the product in the pipes and equipment is experienced.

Apparent losses/gains: These losses (or gains) lead to a wrong record of the operation efficiency and may conceal real physical losses. By employing proper operational/recording techniques and by using approved, maintained, and accurate gauging equipment, it should be ensured that apparent losses are kept at the minimum level available. For this purpose, reconciliation and calibrations should be tracked.

Reconciliation: Whether an operation is carried out or not at the terminal, the terminal needs to be sure that its products in the storage tanks do exist and that their loss tolerances are within the limit values. Therefore, it must make inventory reconciliation regularly. Daily reconciliation and meter reconciliation should be done daily. The following failures should be avoided:

- The sales/transfer movements which have been recorded twice by mistake
- Inaccurate gauging and reading of sales/transfer quantities
- Incorrect reading of the closing values of the meters
- Spillage or the physical losses in the repair of meters
- Unrecorded sales/transfer movements

Tank reconciliation: Besides the fact that daily tank reconciliation is obligatory to track the inventory, it is also necessary to notice and prevent possible spillage, leakage, and uncontrolled product outflow from the tank early. An increase in the product in a tank and a similar decrease in the product in another tank indicate the failure of sales, transfer, loading or receipt of the product. Any abuse should also be detected at the early stages likewise.

Equipment verification and tank calibrations

It should be ensured that any gauging equipment used during inventory management and reconciliation is calibrated and has a valid certificate. The equipment which requires calibration/verification includes Meters, Calibration Tanks, Injection Systems, Tanks, Tape Measures, and Thermometers.

5. MEASURES IN LOSS MANAGEMENT ACCORDING TO THE FAILURE MODES AND EFFECTS ANALYSIS

The below-mentioned principles should be implemented meticulously to keep the Losses/Gains within the limits with the FMEA performed.

- The tanks should absolutely be gauged daily. Gauging can be carried out either manually or with the ATG (Automatic Tank Gauging) system. Attention should be paid to perform gauging at the same hours of the day. In this way, it will be ensured to track the trends which take place for reasons like expansion depending on the temperature of the product.
- Be sure that all product movements are recorded properly and accurately.
- The physical inventory gauged in the tank and the recorded inventory should be compared, and measures should be taken urgently if losses/gains which exceed the limits are detected.
- All staff members who take part in the tank site operations should know their duties completely, and the staff members with adequate competence should be used in tank gauging. The gauged values obtained should be recorded flawlessly.
- To gauge the tank accurately, only one operation can be carried out simultaneously. Only supplying can be performed or only sale can be made. Depending on the operation being done, the other inlets or outlets of the tank have to be closed.
- The manual equipment or automation systems used to gauge the tanks should absolutely be calibrated according to the frequency specified. Tape measures, meters and thermometers exemplify the tank gauging devices required to be calibrated. Especially if the tape measures have been creased or bent or if the part of its connection with the plumb line has become disconnected, one should stop using them without delay.
- The ATG values should be verified. Unless there are results which are out of tolerance among the daily loss/gain values, the ATG values will be verified by manual gauging at least once a month by means of a tape measure the calibration of which one is sure of.
- One will be sure that there is no leakage in the tanks, pipe circuits or manifolds.
- The research made in the event that the operational loss/gain values have been found to be outside the limits should be concluded and reported in 2 days.
- By checking the inventory daily, one should be sure that the inventory system works properly. The checks performed will be recorded, and the research process should be launched at the moment when one sees results which are out of tolerance.
- One should be sure that the product in the pipelines is always at the same state both before and during reconciliation. For instance, if it is found full before reconciliation, it should be full during reconciliation.
- Measurements will be taken and recorded before and after drainage during the tank water drainage processes. In this way, the water discharged from the tank will have been prevented from being evaluated as a product.

6. CONCLUSION

The only asset owned by fuel storage and distribution terminals is the fuel products coming from within the country and abroad. Fuel products are of great importance in energy, aviation, land transport, sea transport, and oil & gas sectors. Checking the loss of the fuel products with such an important asset value is also of great importance. With this study, a failure modes and effects analysis was made in order to minimize the failures arising from the origins of loss at one of the largest fuel terminal of Turkey, to preserve the terminal resources, and to ensure their conformity with the legal legislations and regulations. According to this analysis, Transit vessel unloading, National marker operations, road tanker sales operations, the unloading of the vessel

containing a national product, transfers performed with the surrounding terminals and the transfers that the terminal carries out within it can be mentioned as sequential failure origins. As described in the previous sections, the reasons for the failures resulting from the origins of loss are vessel operations, internal transfers at the terminal, pipeline operations, road tankersales operations, and national marker operations. When the degree of significance of the failures in these operation processes is investigated, it will be true to evaluate the effects induced by the origins of loss with precedence. That is, before all, the legal legislations have to be fulfilled to the letter. These legislation obligations have been drawn up with the rules stipulated at terminals by such institutions as the (EMRA), the Directorate General for Customs Enforcement, Municipalities, the Ministry of Industry and Trade, the Port Authority, the Ministry of Maritime Affairs and Communications, and Tubitak and take precedence over the levels that the companies constituting the terminal have specified themselves. That is, the limitations of a terminal should always aim to remain below the limits specified by the legislations.

The second problem to stem from the failures of the origins of loss is the confirmation that the transit products stated to be at the terminal have reached the concentration value required to be brought to the level at which they can be sold domestically by means of national marker operations. Owing to the differences likely to be experienced here, the people who are responsible at the terminal will have been confronted with illegal cases and both they will be exposed to a legal sanction and the company may be shut down. In addition to the national marker concentration here, the total product quantity at the terminal and the quantities that the EPDK has been notified of have to be equal. Otherwise, any voluntary or involuntary difference arising from the terminal accounts during an audit may reach such dimensions as the shutdown of the workplace concerned.

It will be the contracted dealers of the company, i.e. customers, that will be affected by the negative cases to arise from the failures of the origins of loss due to road tankersales operations. To control and prevent them, calibrations and system checks may be performed in specified periods. Moreover, the amounts of loss specified by the companies, how the operation is carried out within the company, and whether the job is done by reliable staff are investigated; the root cause analysis of the reasons for the origins of loss is made; and the problems in terminal lines or connections are interrogated. In line with this information, it is concluded that the terminal is not managed well and that hitches are experienced and it is intended to eliminate the problems by investigating the problems arising from the vessel. Depending on the problems likely to be experienced here, a bad brand image might be created with financial penal sanctions. Surely; the company instructions, procedures, rules, control units, culture and management skills are important to prevent the gain/loss factors. But; the most important factor which must be taken into consideration when providing the control processes is the consideration of the “human” factor obliged to fulfill the requirements. The greatest cause among the reasons for the lossin the fuel tanks is inaccurate gauging due to the human error, the failure to carry out the available control and maintenance regularly, and the divergence of inventory calculations as a result of this inaccurate gauging. The greatest problem experienced in inventory is caused by the disagreement between the physical inventory and the recorded inventory and the differences between them. The sequences done for the failure modes and effects analysis of all these origins of loss have been performed by determining them according to the relative and interpretation-based limitations desired by the companies themselves, except for the legal legislations and regulations. Unlike sequences and unlike sanctions are likely to occur under different conditions and in different studies. What is essential in the management of these processes is the desire of companies to ensure success and stability for their processes.

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