

Availability Analysis of Avtur/Jet A-: A Case Study on An Aircraft Fuel Supply Company

Efraim Dandy Pandawa Setiaji ^{1*}, Ibnu Lukman Pratama ²

^{1,2} Politeknik Energi dan Mineral Akamigas, Jl. Gajah Mada No.38 Cepu, Kabupaten Blora, 58312, Indonesia

¹ efraimdps@gmail.com

* corresponding author

ARTICLE INFO

Article history

Received : 17-01-2023

Revised : 27-07-2023

Accepted : 27-07-2023

Keywords

Avtur;

Stock Resilience;

Storage Tank;

Pandemi;

ABSTRACT

AY Airport is an international airport that continues to operate every day. The need for aviation fuel or Avtur is always needed and not in small quantities. The condition of the Covid-19 pandemic, which requires X Company to meet fuel needs regardless of the circumstances, is a challenge for X Company. With current conditions that are always changing, an analysis of stock resilience was carried out at the Avtur storage tank facility in 2018-2022 to identify the coverage of days that Y Depot the regulations issued by BPH Migas and Pertamina Aviation. The results stated that stock resilience was at a good level during the pandemic with resilience above 9 days, and some stocks were declared critical in the pre-pandemic period.

1. INTRODUCTION

Indonesia's dynamic condition since the Covid-19 pandemic is an unusual and very rare event. Especially considering that the duration is not short, it has not even ended until now. The fickle and constantly mutating virus is a major cause for governments and all citizens to be confused about adjusting the regulations that will be put in place. The impact of this event is directly related to the activities and mobility of people who are hampered and restricted (Fatmaningdyah & Fatchoelqorib, 2021).

Based on the journal of the College of Aviation Aviation, data shows that passengers who fly have decreased by almost 3x compared to pre-pandemic conditions. This big spike is seen from domestic flights in 2019 and 2020 (Sugiarti, 2020). Conditions like this are a challenge as well as an obstacle that companies inevitably have to face.

The only provider of fuel for aircraft in Indonesia, whether domestic or international flights at various airports is PT. X. By looking at the previous statement, it can be concluded that when flight frequency changes because it depends on the conditions and regulations imposed, it is not an easy thing for PT. X to maintain and adjust to the needs of consumers. One of the units managed by PT. X is an Aircraft Refueling Depot (DPPU) Y as a domestic aviation fuel product provider (Amanda, 2019).

Especially when the author knows that the shelf life in Depot Y itself is relatively small when comparing with Depots in other big cities. With a high frequency of flights including commercial flights, TNI/Polri and VIP, With an average number of flights of 181 thousand passengers every month (Pura, 2023), depot Y's capacity should be greater than that currently available.

Based on this background, the author conducted an analysis by comparing the resilience of pre-Pandemic and pandemic stocks with regulations set by BPH Migas and Pertamina Aviasi.

2. THEORETICAL FRAMEWORK

The Effect of the Pandemic on Aviation

The Covid-19 pandemic that occurred in Indonesia had a major impact on various sectors, especially the air transportation sector. Before Permenhub 25/2020 was issued, flights were still allowed to operate with reduced frequency and restrictions on the number of passengers. However, the regulation also stipulates that all travel is prohibited until May 31, 2020. The regulation makes the



statistics on aircraft movement decrease significantly. The movement of aircraft if we look at statistical data has experienced a very significant decrease up to 86.7% for aircraft and 99.7% for passengers (Lita Yarlina et al., 2021).

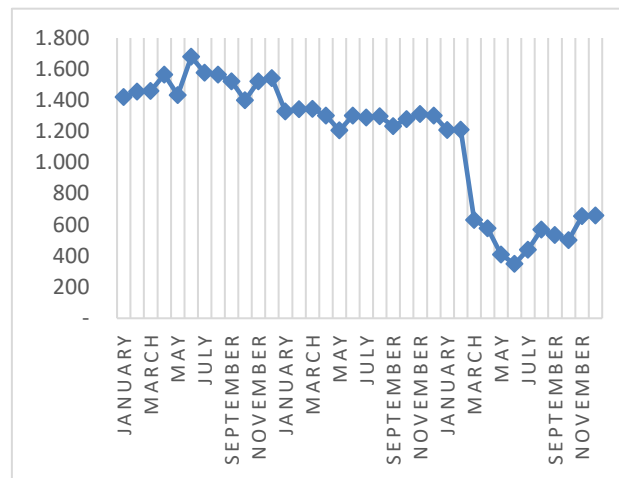


Figure 1. Flight Frequencies at AY Airport 2018-2020

Coverage Days

Coverage Days is always related to the provision of operational fuel reserves stored by the Business License Holder within a certain period of time at the storage facility. The business license holder in question is a business entity that has a business license for trading oil and natural gas in general trading activities for fuel oil product. Storage facilities for operational fuel reserves, namely storage devices used for receiving, collecting, storing, and distributing oil product at oil terminals, depots and/or other storage areas.

In this study, the facilities in question are storage tanks, refuellers and various other types of storage. As is generally used to store fuel products. Coverage days is one of the most crucial factors that must be considered at all times. Stock holdings are calculated to meet the Daily Objective Through distribution. With the maintenance of stock resilience and existing operating patterns, the sales or acceptance process will not having problems. Coverage Days in a depot is influenced by several factors, such as the design and construction of storage tanks related to stockpiling capacity, as well as readiness to anticipate increased sales in the future.

The aviation fuel storage tank is different from the general fuel storage tank. This difference lies in the facilities and special equipment used to ensure quality and ease of quality control. The Jet A-1 and aviatoin gasoline storage tanks must be equipped with floating suction, the inside is covered with epicoat, and there must be a drain line (Zhang et al., 2018).

As for the number and size of tanks at the work site, there must be sufficient availability in accordance with the working capacity by paying attention to the things bellow:

1. Peak period sales volume;
2. Minimum inventory level;
3. Receiving tank operating pattern;
4. Period of regular tank cleaning;
5. Schedule of annual inspection of storage tanks.

Refueller tanks must have a maximum tank compartment size in accordance with ground transportation regulations. The tank is equipped with internal baffle plates to reduce product shock in the tank. Each compartment (bulkhead) shall be equipped with a manhole to allow internal inspection

without entering the tank when required for cleaning or repair. The refueller tank has a safe capacity by considering 3% ullage.

Coverage Days Equation Based on BPH Migas Regulation 2020

The provision of operational fuel reserves is calculated from the average daily distribution volume. The stock resilience can be calculated by calculating the total safe capacity and average daily sales(BPH, 2020).

$$CD_{daily} = C_{daily} / V_{average}$$

Where,

CD_{daily} : Daily Coverage Days/CD (day)

C_{daily} : Daily fuel operational volume (liter/day)

$V_{average}$: Average daily distribution volume of fuel (liter/day)

The average daily distribution volume of fuels is obtained using the following equation :

$$V_{average} = \Sigma V / \text{total days}$$

Where,

$V_{average \text{ distribution}}$: Average daily distribution volume of fuel (liter/day)

ΣV : Total volume of average daily distribution in the previous year/planned average daily distribution in the current year (liter)

Total Days : Number of days in 1 year (day)

After calculating the daily CD then proceed with counting the CD in the current 3 month period (quarterly) using the following equation :

$$CD_{quarterly} = \Sigma CD_{daily} / \text{Jml hari}$$

Where,

$CD_{quarterly}$: Quarterly average Coverage days/CD (day)

ΣCD_{daily} : Daily Coverage days/CD (day)

Total Days : Total days in quarterly (day)

The stages set by the BPH Migas regulations are related to the provision of fuel operational reserves:

- a) From 2020 to 2021, Business License Holders are required to provide Fuel Operational Reserves with a minimum coverage period of 11 (eleven) days;
- b) From 2022 to 2023, Business License Holders are required to provide Fuel Operational Reserves with a minimum coverage period of 17 (seventeen) days.; and
- c) In 2024 onwards, business license holders are required to provide Operational Fuel Reserves with a minimum coverage period of 23 (twenty three) days.

Coverage Days Based on Pertamina Aviation Guidelines

Storage Tank Stock Resilience / Coverage Days is the number of tank contents in a safe capacity divided by daily distribution which aims to ensure the availability of stock in the depot(Furifatimah & Lukman, 2021). The analysis is then carried out by calculating the resilience of the stock based on the company's guidelines, namely

$$\text{Coverage Days (CD)} = \text{Real Pumpable Stock} / \text{Daily Objective Thruput (DOT)}$$

With criteria as below :

Days	Description
1-6	Red; Critical
6-9	Yellow; Less than ideal
>9	Green; Good

Storage Facility Utilization Rate

If in the implementation of oil distribution, distribution activities are aimed at improving the quality of service to consumers (Asha et al., 2023). This needs to be analyzed to see the readiness of the stockpiling facilities and facilities, which in this case is the stockpiling tank. In this case, a high percentage means that the storage tank utilization rate is getting better. Meanwhile, if the percentage value is at a low level, then the utilization rate is not in a good condition. In addition, there is also the utilization rate of the storage tank at XYZ Company which can be calculated using the following calculations (Zain et al., 2011) :

$$P = (Up/Ut) \times 100\%$$

Where,

P : Facility utilization rate (%)

Up : The size of the used facility with the existing conditions

Ut : Size of available facilities

The formula above is a general Utilization calculation formula based on the journal that will be adjusted into the equation below (Wibisono et al., 2022):

$$\text{Utilization Rate} = (\text{Average Daily Stock}/\text{Max Capacity}) \times 100\%$$

3. RESEARCH METHOD

A. Data Sources

In this research, the data obtained comes from primary data sources and secondary data sources. Primary data sources or data that researchers collect directly in the field and conduct interviews with supervisors and leaders in the company. An example of the data obtained from the interview is the *Round Trip Days* data. As for secondary data, researchers collect indirectly through documents, and archives in the company to be processed into coherent data so that it can be displayed to readers (Gay et al., n.d.).

B. Data Collection Techniques

Observation

Observation or observation is carried out directly on an object or activity that occurs in the field. Observation aims to ensure that the data obtained can be ascertained properly, accurately and actually. From observations, some problems or even discrepancies will be found for further analysis later.

Interview

Interviewing is an activity carried out by researchers to obtain data through questions asked by researchers to interviewees. In this case, the interviewees were the workers and leaders at Depot Y.

Documentation

Documentation is a method of collecting data that is carried out by analyzing, collecting and processing data through documents, images, or other media contained in the company. In this study, the media in question can be in the form of notes pasted in the operational room, logbook, or so on.

C. Data Analysis Techniques

Processing by calculating, processing and presenting existing data using appropriate methods. In data processing using descriptive and inferential statistics. Where descriptive statistics themselves describe the data by drawing conclusions based on a summary of the data. Meanwhile, inferential statistics is to draw conclusions from the population based on data. This statistic starts from the process of testing data with line graphs to calculations using established formulas, comparing against qualitative data collected, and so on.

Data analysis begins by looking at the patterns of data that have been obtained and collected. It starts with looking at the data visually to see how sales/sales compare between pre-pandemic and pandemic-era sales. Then after seeing how the existing data patterns are, the data is processed to calculate coverage days every 24 months during the pandemic and before the pandemic. The results of the calculations will be viewed and validated based on regulations set by BPH Migas and Pertamina Aviiasi Pusat. The utilization of stockpile tanks can also be seen whose calculations involve stock and distribution data. It ends by analyzing the factors that influence the change in flight frequency and sales/sales of Avtur.

4. RESULT AND DISCUSSION

A. The Effect of the Pandemic on Aviation

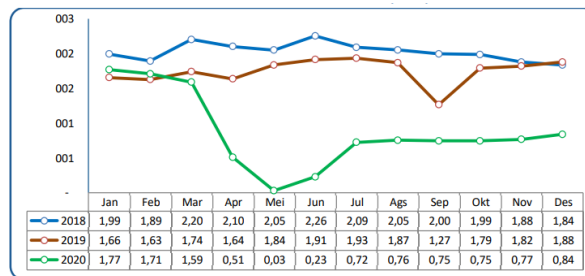


Figure 1. 2019-2021 Flight Frequency Chart



Figure 2. Passenger Movement Chart 2020

By looking at the chart above, it can be seen that the biggest decline occurred in April 2020. In that month a ban was imposed travel applied on a national scale. With the extreme decline occurring across national aviation, this has also impacted many other things. In addition, by looking at passenger movements, it can be concluded that there is a very strong relationship between passenger movements and flight frequency. Also, those chart are issued by Central Agency for Statistics and Angkasa Pura I.

The Covid-19 pandemic that occurred in Indonesia had a major impact on various sectors, especially the air transportation sector. Before permenhub 25/2020 was issued, flights were still allowed to operate with reduced frequency and restrictions on the number of passengers. However, the

regulation also states that all travel is prohibited no later than May 31, 2020. The regulation made the statistics of aircraft movements drop very significantly. Aircraft movement when we look at statistical data has decreased very significantly to 86.7% for aircraft and 99.7% for passengers (Lita Yarlina et al., 2021)

B. Stockpile Tank Stock Resistance

Stock resilience is always related to the provision of fuel operational reserves stored by Business License Holders within a certain period of days at the storage facility. The business license holder in question is a business entity that has an oil and gas commercial business license in general commercial activities of Fuel Oil (BBM). Fuel operational reserve storage facilities are storage tools used for fuel receiving, collecting, sheltering, and dispensing activities at fuel terminals, depots and/or other storage areas.

In this study, the facilities in question were stockpile tanks, refuellers and various other types of storage. As is generally used to store fuel products. The resilience of stockpile tanks or coverage days is one of the most crucial factors that must be considered at all times. Stock resilience is calculated to be able to meet the *Daily Objective Thruput* (DOT) distribution. With the resilience of the stock and existing operating patterns, the sales or acceptance process will not experience problems. The resilience of stockpile tanks at a depot is influenced by several factors, such as the design of stockpile tanks related to stockpiling capacity, as well as readiness to anticipate an increase in sales in the future.

Aviation Fuel Oil Heap Tanks are different from stockpile tanks for fuel in general. This difference lies in the special facilities and equipment used to ensure quality and ease of quality control. In the stockpile tank avtur and Avgas should be equipped with *floating suction*, the inside is coated with epicoat, drain path (Aviation, 2019).

The number and size of tanks at the work site must be sufficiently available according to the working capacity by paying attention to the following:

1. Peak period sales volume.
2. Minimum inventory level.
3. The operation pattern of the reception tank.
4. Period of routine tank cleaning (Tank Cleaning).
5. Annual inspection schedule of stockpile tanks.

The Refueller tank must have the maximum size of the tank compartment in accordance with ground transport regulations. The tank is equipped with an internal sealing plate plate to reduce product shock in the tank. Each compartment (bulkhead) must be equipped with a Manhole to allow internal inspection without entering the tank when necessary for cleaning or repair. The refueller tank has a safe capacity taking into account 3% ullage (Aviation, 2019).

1. Stock Resilience Based on BPH Migas Regulation th.2020

The provision of fuel operational reserves is calculated from the average daily distribution volume. The resilience of the stock can be calculated by calculating the total safe capacity and average daily sales (BPH, 2020).

$$CD_{\text{dharian}} = \text{Daily Charian} / \text{Vrata Daily}$$

Where

Cdharian : Coverage Days (CD) Daily fuel operational reserves (days).

Charian: Daily fuel operational reserve volume (liters/day).

Daily average distribution: The average daily distribution volume of fuel (liters/day).

The average daily distribution volume of BBM is obtained using the following equation:

Daily average = $\Sigma V / \text{Jml days}$

Where

Daily average distribution: Average daily distribution volume of fuel (liters/day)

ΣV : Total average daily distribution volume in the previous year/average daily distribution plan in the current year (liters)

Jml days: Number of days for 1 year.

After calculating the daily CD, then proceed to calculate the CD in the current 3-month period (quarterly) using the following equation:

Quarterly average CD = $\Sigma \text{CDdaily} / \text{Jml days}$

Where

Quarterly average CD: Quarterly average coverage days (CD)

$\Sigma \text{CDharian}$: Jml coverage days (CD days) daily fuel (days)

Jml days: Jml days for 1 current quarter period (days)

The stages set by BPH Migas regulations related to the provision of fuel operational reserves:

- a) From 2020 to 2021, business license holders are required to provide fuel operational reserves with a minimum time coverage of 11 (eleven) days;
- b) From 2022 to 2023, Business License Holders are required to provide fuel operational reserves with a minimum time coverage of 17 (seventeen) days; and
- c) In 2024 onwards, business license holders are required to provide fuel operational reserves with a minimum time coverage of 23 (twenty-three) days.

Where **Charian** is equivalent to Real Pumpable Stock and *Vrata* is equivalent to Daily Average Sales. Coverage Days also considers other factors such as RTD (Round Trip Days) which is used as material for calculating when to make a booking. The RTD present at Depot X is 1 day. By looking at the data from the calculation of Coverage Days in April 2020 – March 2022, with Coverage Days of 14.4 days, it is very good.

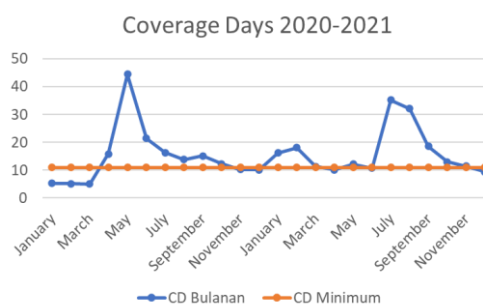


Figure 3. Calculation of Coverage Days

The Coverage Days chart is obtained after doing monthly, quarterly and annual calculations. Then the results are obtained at each point. It can be seen on the chart that some points are below the minimum limit. The red status is given at each of these points based on the provisions of the regulations issued by BPH Migas with the sound, Evaluation of the Regulatory Agency on the implementation of the Provision of Fuel Operational Reserves by Business License Holders is carried out for a period of 3 months.

However, the regulations issued by BPH Migas have not regulated the fuel operational reserves that must be provided before 2020. Therefore, the Color Code has not been given and the analysis for coverage days before 2020 will be carried out on a discussion comparing with the central Pertamina Aviation rules.

The minimum time coverage limit for each period since the regulation was established is in 2020 to 2021 for at least 11 (eleven) days, from 2022 to 2023 for at least 17 (seventeen) days. Based on this decision, the results of the quarterly evaluation can be reviewed by comparing the calculation of CDs and the provisions of BPH Migas.

1. Stock Resilience Based on Pertamina Aviation Guidelines

The analysis is then carried out by calculating the resilience of the stock based on the company's domicile, namely

$$\text{Coverage Days (CD)} = \text{Real Pumpable Stock} / \text{Daily Objective Thruput (DOT)}$$

With criteria as below:

Coverage days	Information
Day	Red
1-6	Yellow
6-9	Green
>9	

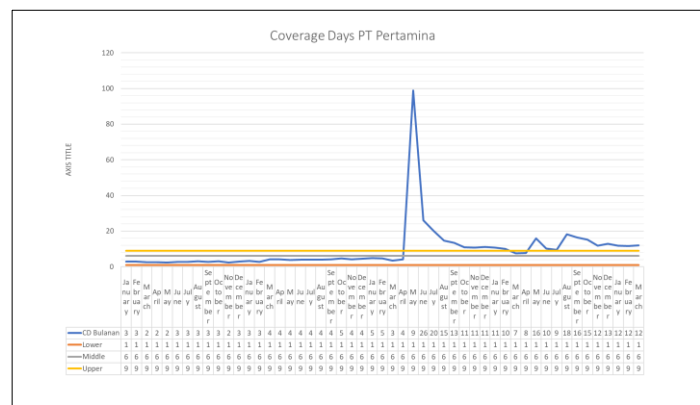


Figure 4. Coverage Days Calculation

The data presented in figure 4 shows that not every month coverage days at the depot are always in a safe condition or are in a green status. The green color interprets that the stock's resilience is safe. The red color interprets that the stock's resilience is already in an unsafe condition, so the depot needs to place an order immediately. If the color is yellow, the stock's resistance condition is at an almost critical/emergency level to immediately place an order (Iwan, 2022).

Analysis of the value of the CD needs to be done to see why the CD can be in the green, yellow and red categories. For green or safe categories, it may not be so much noticed because this category is said to be non-problematic. However, if we look at May 2020, there is a discrepancy where the calculation of CDs is worth up to 99 days. Of course, this does not make sense if we look at the naked eye and only focus on the numbers in the month. After searching, it turned out that dot in that month was set at only 5 KL and Real Average Sales at 11 KL. Thus, when doing calculations involving Real Pumpable Stock with DOT, a very high yield is obtained influenced by a very small divisor value.

Then, for the yellow category seen in March & April 2021, it happened because the set DOT value had exceeded 60,000. Based on the results of the author's analysis, Coverage Days at Depot X will be in the yellow category if the DOT set from the center is already worth ≥ 57 KL. However, with the condition of real pumpable stock that is not much different from that in those 2 (two) months.

Meanwhile, for the red category it happens because the DOT value set from the center for Depot X is quite high. In fact, before the onset of the pandemic, the minimum value of DOT was not less than 100KL per day. If we look at the total safe capacity of all tanks in Depot X which is only 492 KL, of course a DOT of 100 – 150 KL will make the stock resistance will not exceed 4 days. Nonetheless, although a lot of data shows that over the years Depot X has been in the red category, we need to

remember that the RTH (Round Trip Hours) of Bridger that transports Avtur from Rewulu TBBM is only 4-6 hours.

C. Storage Facility Utilization Rate

In addition, there is also the utilization rate of the stockpile tank at Depot X which can be calculated using the following calculations:

$$P = (Up/U_t) \times 100\%$$

Where

P : Facility utilization rate (%)

Up : The size of the facility is used with existing conditions

Ut: Available facility sizes

The above formula is a general Utilization calculation formula based on the journal J. Zain, Y. Aditya, D. (Zain et al., 2011)(Zain et al., 2011) which will be adjusted into the equation below:

$$\text{Utilization rate} = (\text{Average Daily Stock}) / (\text{Max Capacity}) \times 100\%$$

Figure 5 presents data on the percentage of utilization rates of stockpiling facilities at Depot X. Facilities and facilities in question are stockpile tanks and refuellers. The calculation of the two sarfas is because considering the resilience of the Depot Y stock based on the total of all existing storage locations.

If we look at the data displayed in May & July 2019, then January 2021, it appears that the utilization rate is more than 100%. Given that the stored stock is unlikely to exceed the existing maximum capacity or if it exceeds 100% it can be said to be overcapacity, this needs to be analyzed further. The results show that the excess usage is only a maximum of 1.314%, of which the error is estimated to come from human error. It is possible, this error occurs when the operator performs stock reporting on the supervisor for recapitulation. However, the measurements taken experienced a slight miss accuracy. Thus, 1% excess utilization that occurs can be explained.

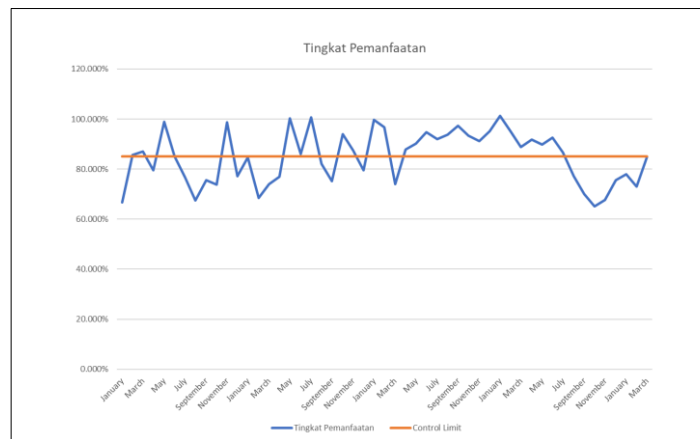


Figure 5. Storage Tank Utilization Rate

By comparing the interview results with the calculation results, the interview results said that the storage tank utilization is said to be good if it is above 85%. Meanwhile, looking at the utilization table, October 2021 became the month with the lowest utilization of hoarding facilities, which was 65%. However, when the lower percentage of utilization indicates that the average stock stockpiled in the month is not so much, this has no effect because the DOT per day of the month is only 23 KL.

D. Analysis of Factors Affecting Stock Resilience of Avtur Depot X

Then, the relationship between stock resilience will be influenced by various factors that are directly related to total demand. In addition, the facilities and facilities owned by Depot Y also directly affect the resilience of the stock in the depot. Therefore, the author analyzes what factors affect flight frequency. As for based on Winahyu et al., 2019 [7] , Lestari et al., 2020 [8], Budhi & Suyitno, 2020 [9] conclusions are drawn as below:(Budhi & Suyitno, 2020)

1. Regulations that will adjust to the covid pandemic will provide a change in sales.
The existence of Special Events as analyzed at the beginning of the Chapter. The months that experience an increase in sales / peak season every year are influenced by certain events such as Eid al-Fitr, Christmas, and New Year.
2. The occurrence of an emergency or something that must be done.
3. Cuca, Climate, or other natural symptoms.
4. Maintenance or maintenance at stockpiling facilities. Such as tank cleaning on stockpile tanks or refuellers.
5. Fluctuating ticket prices due to adjustments in flight capacity and frequency

5. CONCLUSION

By looking at the results of the analysis, it can be concluded that, based on the analysis and evaluation of coverage days contained in Depot X, it is concluded that there are several months that are in unsafe conditions, but do not interfere with operational conditions. Then, Coverage Days are in the range of 3-5 days for the period before the pandemic. As for the pandemic period in the range of 8-15 days, the utilization rate of stockpile tanks during pre-pandemic and pre-pandemic conditions is considered quite good considering the utilization rate is in the range of 70-90%, and the factors that affect stock resilience are the influence of flight frequency, the condition of depot facilities and facilities, and also natural conditions.

REFERENCES

- Amanda, G. (2019). *BPH Migas Sebut AKR Belum Bisa Jual Avtur*.
<https://sindikasi.republika.co.id/berita/ppdk8j423/network>
- Asha, A. A., Dulal, M., & Habib, D. A. (2023). The influence of sustainable supply chain management, technology orientation, and organizational culture on the delivery product quality-customer satisfaction nexus. *Cleaner Logistics and Supply Chain*, 7(April), 100107.
<https://doi.org/10.1016/j.clscn.2023.100107>
- Aviation, P. P. (2019). *Pompav Buku 4*. 37.
- BPH, M. (2020). Peraturan Badan Pengatur Hilir Minyak Dan Gas Bumi. In *Penyediaan Cadangan Operasional Bahan Bakar Minyak*.
<http://etd.eprints.ums.ac.id/14871/%0Ahttps://doi.org/10.1016/j.cell.2017.12.025%0Ahttp://www.depkes.go.id/resources/download/info-terkini/hasil-risikesdas-2018.pdf%0Ahttp://www.who.int/about/licensing/%0Ahttp://jukeunila.com/wp-content/uploads/2016/12/Dea>
- Budhi, & Suyitno. (2020). *Dampak pandemi covid-19 bagi transportasi udara nasional*. 41.
- Fatmaningdyah, Y., & Fatchoelqorib, M. (2021). Kebijakan Perjalanan Udara Di Masa Pandemi Corona Virus (Covid-19). *Aviasi: Jurnal Ilmiah Kedirgantaraan*, 17(1), 21–34.
<https://doi.org/10.52186/aviasi.v17i1.56>
- Furifatimah, A., & Lukman, I. (2021). *Analisis ketahanan stok produk avtur/ jet a-1 di pt.xyz tanjungpinang*. 1(November), 1545–1556.
- Gay, L. ., Geoffrey, M., & Airasian, W. P. (n.d.). *Educational Research Competenies For Analysis and*

Applications.

- Iwan. (2022). *Minimum Coverage Days DPPU*.
- Lestari, Dewanti, & Priyanto, S. (2020). *Faktor – Faktor yang Mempengaruhi Perkembangan Angkutan Udara Rute Sumenep – Surabaya pp . 4(2)*, 149–166.
- Lita Yarlina, Subekti, S., Lindasari, E., Mora, M., Widadi, N., Tito, Yusmar, Kusumawati, D., Zulaichah, & Sitompul, M. R. (2021). Dampak Pandemi Covid-19 Terhadap Penerbangan di Indonesia. *Warta Ardhia*, 42(3), 139–148. <https://www.neliti.com/publications/234217/faktor-penyebab-kelelahan-dan-stres-kerja-terhadap-personel-air-traffic-controll>
- Pura, P. A. (2023). *Meningkat 52%, Bandara Internasional Jenderal Ahmad Yani Semarang Layani 181.298 Penumpang Pada Periode April 2023*.
- Sugiarti. (2020). *Analisis Dampak Covid 19 Terhadap Penerbangan Di Indonesia*. 2507(February), 1–9.
- Wibisono, Muslih, R., & Widiastuti, H. (2022). Sludge Interface Measurement in The Storage Tank Utilizing Neutron Backscattering Technique: A Field Experiment. *International Journal of Disaster Risk Reduction*, e10720. <https://doi.org/10.1016/j.heliyon.2023.e17948>
- Winahyu, S. H., Wahyudi, D., & Puspaningrum, H. (2019). Faktor Faktor Yang Mempengaruhi Penurunan Jumlah Penumpang Pesawat Udara di Bandar Udara Tunggul Wulung Cilacap. *Warta Penelitian Perhubungan*, 25(4), 280. <https://doi.org/10.25104/warlit.v25i4.730>
- Zain, J., Aditya, Y., Fakultas Perikanan dan Ilmu Kelautan Universitas Riau, D., & Fakultas Perikanan dan Ilmu Kelautan Universitas Riau, M. (2011). Efisiensi Pemanfaatan Fasilitas Di Tangkahan Perikanan Kota Sibolga. *Jurnal Perikanan Dan Kelautan*, 16, 1–11.
- Zhang, W., Song, Z., Song, J., Shi, Y., Qu, J., Qin, J., Zhang, T., Li, Y., Zhang, H., & Zhang, R. (2018). A systematic laboratory study on an anticorrosive cool coating of oil storage tanks for evaporation loss control and energy conservation. *Energy*, 58, 617–627. <https://doi.org/10.1016/j.energy.2013.06.044>