Jurnal Pendidikan dan Konseling
Volume 4 Nomor 5 Tahun 2022
E-ISSN: 2685-936X dan P-ISSN: 2685-9351
Universitas Pahlawan Tuanku Tambusai

Optimization Level Transmitter Storage Tank To Increase Latex Product Storage Performance At Dow Chemical Indonesia

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Abstrak

PT. DOW Chemical Indonesia telah mengoperasikan pabrik sekitar 20 tahun dengan proses kinerja tinggi dan terus meningkatkan kapasitas untuk memberikan kepuasan pelanggan kami, dengan kapasitas sekitar 30.000 ton / tahun. Selain S/B Lateks, PT. DCI juga menjual produk blending yang merupakan campuran dari produk base-lateks dengan komposisi tertentu. Lateks komposisi ini juga (PT. DCI) telah menghasilkan 23 jenis lateks, 15 merupakan produk blending lateks. Setiap tangki perlu tingkat data yang akurat untuk menyediakan pelanggan kami. Kami membutuhkan ketelitian yang tinggi dalam pengukuran level di tangki penyimpanan kami. Ini berarti mengatur pengiriman produk kami ke pelanggan. Dow Chemical Indonesia memiliki sebelas tangki sebagai 3 tangki untuk produk karpet dan 8 tangki untuk produk kertas, tetapi semua penyimpanan tidak untuk didedikasikan untuk produk khusus, semua produk memungkinkan dialokasikan untuk kedua produk. Hanya tiga produk penyimpanan yang diidentifikasi bermasalah. Dasar perhitungan Kegagalan, MTBF, Ketersediaan, Tingkat Kegagalan, Keandalan pemecahan masalah dapat mengidentifikasi lebih jelas.Failure Finding Interval risiko kegagalan ganda harus dihitung untuk setiap tangki penyimpanan produk untuk mengetahui tangki mana yang bermasalah. Berdasarkan data tiga produk penyimpanan diidentifikasi.
Kata Kunci: Pemancar Level, Performa, Pengoptimalan.

Abstract

PT. DOW Chemical Indonesia has been operated the plant about 20 years with high performance process and continue increasing capacity to provide our customer satisfaction, with capacity about 30000 ton / year. Besides S/B Latex, PT. DCI also sell product blending representing mixture from product base-latex with certain composition. This composition Latex also (PT. DCI) have produced 23 type latex, 15 representing latex product blending. Each of tank need to accurate data level for provide our customer. We need high correctness in measurement of level in our storage tank. This means to arrange delivery of our product to customers. Dow Chemical Indonesia have eleven tanks as 3 tanks for carpet products and 8 tanks for paper products, but all storage is not for dedicated for special products, all products allows allocated for both the products. Only three product storage are identified have a problem. Base calculation of Failure, MTBF, Availability, Failure Rate, Reliability solving problem can identify more clearly.Failure Finding Interval the risk of multiple failures must be calculated for every product storage tank to know which tank has a problem. Based on data three product storage are identified.
Keywords: *Level Transmitter, Performance, Optimization.*

INTRODUCTION

Back Ground and Company Profile

Latex Emulation Polymer of arising out in the world of effort this time force each every company to make more strategy for producing and developing product which making good the product or services. In the effort for fulfill requirement of consumer which progressively competitive and selective in chiseling and consuming service, company forced to be non-stopped to produce latex and or service in order to more productive and efficient, so that can obtain get profit for company but on the other side can fulfill satisfaction to consumer in using service or product yielded by the company.

Globalization era only the company which can comprehend and can fulfill market requirement which can hold out, company challenged to can reply the market requirement productively the product or service which with quality, which can compete do not only local but whole the world. PT. Dow Chemical Indonesia a company moving industrial area of manufacture producing Synthetic Latex. Product yielded styrene butadiene latex or often we mention by latex synthetic, this factory produce 2 product type which application allotment as carpet backing and top paper coating.

There are our local our customer Dow Chemical Indonesia such as : PT. Tjiwi kimia, PT. indah kiat & pulp, PT. Suria pamenang, PT. Pajar Surya Wisesa, PT. Klasik Karpet, PT. Nobel Karpet, PT. Aqua Kultura, dll. For accommodate export specially only Asia Pacific such as : Asia Pulp & Paper. Until now PT. DOW Chemical Indonesia has been operated the plant about 20 years with high performance process and continue increasing capacity to provide our customer satisfaction. PT. DOW Chemical Indonesia capacity about 30000 ton / year.

PT. Dow Chemical Indonesia (PT. DCI) located in Roadway of km Peacock. 117,5 Countryside Gerem, Cilegon, Banten. [In] industrial area of This Cilegon, standing two plant own Dow Chemical Company. Two plant own the Dow [is] PT. DCI And PT. Pacific Indomas of Indonesia Plastic PT. PIPI what is located in eastside PT. DCI. PT. PIPI produce polystyrene. In north side PT. DCI stand up PT. Unggul Indah Corporation (PT. UIC) producing alkyl benzene sulfonat, while in south of there are PT. Bakrie Kasei Corporation (PT. BKC) yielding purified tereptalic acid (PTA) And polyethylene tereptalate

Location industrial area in Cilegon is constituted by consideration that previously in the site have build PT. PIPI which also own Dow. Beside that selecting of this area of factory because close to source one of especial raw material produce S/B of latex namely styrene. About 60% from raw material of styrene supplied by PT. Styrindo Monomer Indonesia (SMI) which also located in industrial Cilegon area. this Monomer Styrene used by with PT. PIPI producing polystyrene. Site of Merak industrial, Plant building about 14,5 hectare. Because located in same site, second factory of this Dow is diffraction each other share facility with the other plant including administration for employee. Site of Merak plant used together by second factory of this Dow are administration office, park, post of security therewith mosquito, canteen, space for contractor and bridge for the weighing-machine. Others, Infrastructure PT. DCI also have depository warehouse of raw material, depository warehouse of product, main building production office, control room, conference room, maintenance, MCC Room and laboratory area process, area utilities, containment sump, depository tank of raw material, tank butadiene, tank acrilonitril, loading station, and butadiene loading station

There are many kinds of grade S/B of latex produce by PT. Dow Chemical Indonesia (PT. DCI). Every grade differentiated by recipe. Especial difference recipe is substance of enhanced additive. Dow develop recipe depend on pursuant to consumer requirement. difference of Additive enhanced at latex base on characteristic of the desired product, nature of elementary substance to be arranged in coating, and also formula's for coating itself. For application this product S/B Latex produce by PT. DCI

is to industry of paper that is as coating paper. Paper veneering (paper coating) by S/B is latex own high quality in lustrous of paper and ink printed at surface and also in ability print.

The paper needed such as upon which for the magazine, stamp, label paper, paper of packer smoke, paper of gilt edged advertisement, hard cover book, and for the artistic paper. Latex to be used for application of paper may not use substance base on ammonium because can effect to aroma of paper and in order to can fulfill food standard (food grade). Beside upon which formulas paper coating, S/B of Latex produced by PT. DCI is also consumed by industry of carpet upon which glue (binding) in making carpet. Capacities of the plant for produce S/B Latex about 30.000 metric ton per year (wet). All S/B of latex yielded the marketed by the name of trade of Dow Latex (DL).

Besides S/B Latex, PT. DCI also sell product blending representing mixture from product base-latex with certain composition. This composition Latex also (PT. DCI) have produced 23 type latex, 15 representing latex product blending. From so much the product, only two destined by for industry carpet. S/B Latex delivered to consumer use truck isotank which have capacities 23 metric ton, some of product to customer deliver to use drum with capacities 200 liter of per drum, and also use IBC (Intermediate Bulk Container) like Schultz bin that have capacities about 1000 liter. Generally consumer PT. DCI for domestic paper industry but Dow also export to the other company of paper or carpet.

Objective

This case discusses about accurate radar level transmitter for provide latex synthetic for our customer. We need of high correctness in measurement of level in our storage tank. This mean effect to arrange delivery our product to customer. Dow Chemical Indonesia have eleven tanks as 3 tanks for carpet product and 8 tank for paper product, but all storage not for dedicated for special product, all product allows allocated for both the product. This research for special storage area level indicator as not properly function in normal operation. For improvement for increase performance every product storage performance level accurate. So that problem effect to delivery will late to customer. The target this project are eliminate or reduce radar level transmitter failure as refer from data 2020 storage tank. Proposal Idea as refer from research result of storage performance reliability. Giving option for fix the problem and calculate MTBF for current situation.

Methodology

For identified which radar level transmitter poor performance as for latex storage tank. The plant needs the team to identify the problem. According to daily activity not so perform to fix the problem as expectation for almost 100% reliability.

Systematic

Obtain Site plant layout and plant background and company profile. Site of Merak industrial, Plant building about 14,5 hectare. Because located in same site, second factory of this Dow is diffraction each other share facility with the other plant including administration for employee. Site of Merak plant used together by second factory of this Dow are administration office, park, post of security therewith mosquito, canteen, space for contractor and bridge for the weighing-machine. Others, Infrastructure PT. DCI also have depository warehouse of raw material, depository warehouse of product, main building production office, control room, conference room, maintenance, MCC Room and laboratory area process, area utilities, containment sump, depository tank of raw material, tank butadiene, tank acrylonitril, loading station, and butadiene loading station.

Theoretical Background

The theoretical put in from many literature took from Internet, Book, Lecture, etc. For the first talking about Reliability Centered Maintenance and strategy for build the team RCM. Develop what

you believe would be the optimum maintenance plan. Then business-specific factors of cost and benefit can be fully weighed, real-life considerations for program implementation can be given, and the maintenance plan can be tailored to suit corporate needs, objectives, and expectations.

Evaluate Unit Work

Current Condition and latex plant overview. As talking about raw material for PT. Dow Chemical Indonesia (PT. DCI) for making latex S/B consisted of the especial raw material and the raw material supporter. It is amount about fifteen kinds of and composition of raw material used base on recipe of each product to be made.

Process production for making latex on the reactor and product storage before deliver to customer. And Dow Chemical Indonesia have 3 storage for carpet product and 8 storage for paper product, but not have dedicated tank for special both product. And historical data storage tank performance 2020.

Analysis and Problem Solving

In evaluating the Failure Finding Interval calculated every product storage tank to know which are the tank have problem. On the data 2020 from 11unit radar level transmitter not all the tank has problem. Only three product storage are identified.

Base calculation of Failure, MTBF, Availability, Failure Rate, Reliability solving problem can identify more clearly.

METHODS

Oftentimes the terms “prediction” and “estimation” are used interchangeably, however this is not correct. Methods that *predict* MTBF, calculate a value based only on a system design, usually performed early in the product lifecycle. Prediction methods are useful when field data is scarce or non-existent as is the case of the Space Shuttle or new product designs. When sufficient field data exists, prediction methods should not be used. Rather, methods that *estimate* MTBF should be used because they represent actual measurements of failures. Methods that *estimate* MTBF, calculate a value based on an observed sample of similar systems, usually performed after a large population has been deployed in the field. MTBF estimation is by far the most widely used method of calculating MTBF, mainly because it is based on real products that are experiencing actual usage in the field. All of these methods are statistical in nature, which means they provide only an approximation of the actual MTBF. No one method is standardized across an industry. It is, therefore, critical that the manufacturer understands and chooses the best method for the given application. The methods presented below, although not a complete list, illustrate the breadth of ways MTBF can be derived. [*STRATEGIC CORPORATE ASSESSMENT SYSTEMS Inc.]*

The failure rate (λ) = 1/(MTBF)

MTBF = Mean Time Between Failures

Data has identified twelve earth faults in the past twenty years.

MTBF = Total Time in Service/(Number of Failures)

Calculating the Availability required.

A basic assumption must be made when analyzing the MTBF of a system. Unlike mechanical systems, most electronic systems don’t have moving parts. As a result, it is generally accepted that electronic systems or components exhibit constant failure rates during the useful operating life. referred to as the failure rate “bathtub curve”, illustrates the origin of this constant failure rate assumption mentioned previously. The "normal operating period" or “useful life period" of this curve is the stage at which a product is in use in the field. This is where product quality has leveled off to a

constant failure rate with respect to time. The sources of failures at this stage could include undetectable defects, low design safety factors, higher random stress than expected, human factors, and natural failures. Ample burn-in periods for components by the manufacturers, proper maintenance, and proactive replacement of worn parts should prevent the type of rapid decay curve shown in the "wear out period". The discussion above provides some background on the concepts and differences of reliability and *Availability, on the other hand, is the degree to which a system or component is operational and accessible when required for use.*

$$\text{Availability} = \frac{MTBF}{(MTBF + MTTR)}$$

What is the MTTR?

Mean Time To Repair (MTTR) is the most common measure of maintainability. It is the average time required to perform corrective maintenance on all of the removable items in a product or system. This kind of maintainability prediction analyzes how long repairs and maintenance tasks will take in the event of a system failure.

MTTR also factors in to other reliability and maintainability predictions and analyses. MTTR can be used in a reliability prediction in order to calculate the availability of a product or system. Availability is the probability that an item is in an operable state at any time, and is based on a combination of MTBF and MTTR. [*Relex Software corp 2020*]

Types Of Maintenance Activities

An important objective of the workload modeling process is to smooth out the forward workload to suit the maintenance labor resources available. A maintenance plan that generates a smooth forward workload can provide additional cost savings because it supports better planning and allocation of work and better utilization of labor.

The maintenance workload can be considered to have three main components of work:

Level 1 – relates to the basic preventive and condition based inspection maintenance plus essential running repairs which need to be done to ensure that the plant remains in good and reliable operating condition, and that breakdowns are either prevented, or are predicted so that necessary repairs can be planned and executed in a cost efficient manner;

Level 2 – relates to the planned repairs and equipment services which are done as a result of equipment condition detected or measured in the level 1 preventive maintenance work, and;

Level 3 – relates to major equipment overhauls, modifications and/or projects work which is normally planned and done during agreed shutdowns or at time when the equipment is not scheduled to be operating.

In modern organizational thinking, the level 1 maintenance work is performed predominantly by ‘front line’ operations and maintenance shift crews and maintenance day crews, whereas the level 2 work is addressed predominantly through day crews (repair crews) with some use of contract labor to cope with peak demands. The closer to level 3, the more likely that the maintenance work can be ‘packaged’ and offered out for contract. Clearly, the more constant the level 1 workload, the better it can be managed to make maximum productive use of the front line maintenance labor. Similarly, the smoothing of the level 2 workload to reduce overload peaks will make it easier to make maximum use of in-house labor.

Alternatively, if the level 2 work produces ‘clusters’ or regular peaks in the forward workload, then these may be used to define down-day planning requirements so that the work can be ‘packaged’

for application to contract labor sources. The workload smoothing and planning process can have a major impact on the longer term labor requirements for maintenance, and therefore on the cost effectiveness of the maintenance effort.

Maintenance Planning

In structuring the maintenance schedules a number of factors need to be considered including:

1. The production requirements of the plant, and if maintenance windows are available for planned maintenance activities.
2. The skills and availability of the operating and maintenance personnel
3. Availability of special tools, testing and support equipment

Naturally the preventive maintenance recommendations should be carefully considered in terms of their cost effectiveness in reducing the consequences of failure.

Maintenance Programs

One of the purposes of the maintenance program is to provide a simple means whereby a maintenance analyst or planner can be aware of the approximate cost consequences of maintenance planning decisions, and can derive an estimate of maintenance costs and manning requirements for different task frequencies.

In cases where cost or consequence data is vague, a number of simple iterations can be performed to test the sensitivity of frequency decisions against total cost impact. It is intended that once an equipment maintenance strategy (or plan) has been implemented, then a history of routine preventive maintenance actions and/or actual failures will be generated which can later be analyzed statistically to optimize frequencies more accurately. If accurate history data is available to support statistical (Weibull) analysis, then a suitable statistical package should be used.

HASIL DAN PEMBAHASAN

Current Condition And Latex Process Overview

This chapter will be elaborated to hit data requirement obtained from data collecting from experiment and. the data will be processed later on will be analysis at next chapter. Main supplier of synthetic Latex Producer in the world are Dow, BASF, Rohm And Haas, Synthomer, Enichem, LG Corp etc. PT. Dow Chemical Indonesia PT.DCI is one of the 21 latex factory owned by The Dow Chemical Company in all the world. Latex as especial products PT. DCI produced to fulfill the domestic market requirement. Export also according to requirement.

The Dow Chemical Company is fifth biggest chemical company in the world with earnings more than US $ 20 billion per year. this Global company have Head office center in Midland, Michigan, United States. Dow offer chemistry-based solution to more than 160 state in world in so many industrial sector, including of industry automotive, equipments, electronic, furniture, construction, equipments write to write, health supply, agriculture substance and supply, place recreation and food. First factory built Dow in Indonesia is pesticide factory, North Sumatra which start to operate on year 1975. In the year 1993, Dow built again factory polystyrene in Merak, Banten. The Factory joint venture with Salim group so we called the factory joint venture is PT. Pacific Indomas Plastic Indonesia (PT. PIPI). In the year 1999, along with economics crisis which knock over this country, Dow take over all share owned as Salim Group. After Polystyrene running well, DOW decided to build new plant as name is PT. Dow Chemical Indonesia location of the plant also at Merak plant near polystyrene plant.

Raw Material

Raw material used by PT. Dow Chemical Indonesia (PT. DCI) for making latex S/B consisted of the especial raw material and the raw material supporter. It is amount about fifteen kinds of and composition of raw material used base on recipe of each product to be made. Raw material used by most conducive to from outside country (import) and only some of minimizing raw material obtained by from within country. Primary of raw material latex are water, monomer styrene, monomer butadiene, and seed latex. Third of this raw material represent raw material owning biggest composition in each type of latex produced by PT. DCI.

Water

Water which is used as by a especial raw material of making of latex supply from PT. Sauhbahtera. Making latex, water function as " hot wate" because reaction of forming of latex represent reaction exothermal. Others, irrigate also function as media for initiator and media for migration of monomer-monomer into particle latex. Composition irrigate at product yielded by 50%. Before used, water have to be eliminated by content of ionic by demineralization. The target is to prevent the happening of coagulation of particle latex.

Butadiene

Butadiene used in making of latex represent liquid butadiene. Generally composition of butadiene entered/included by into reactor about 40%. In making latex, butadiene give the following contribution " giving effect of softness at yielded latex "improving the nature of adhesive latex "giving flexibility at latex" forming cross linking which have contribution at polymer strength.

Butadiene represent very volatile look like vitamin so that temperature of operation have to be taken care of about 10-15 degree Celsius. In consequence, butadiene always circulation through a heat exchanger with media of cooler of chilled water. Others, pressure in depository butadiene tank have to be taken care of stability. This matter is conducted by padding use nitrogen gas.

Styrene

As does butadiene, styrene used in making of latex represent liquid styrene. Generally composition of styrene entered into reactor about 60%. function of Styrene of making of latex shall be as follows "giving effect of hardness at yielded latex" improving polymer strength "improving rate gleam at paper veneering" lengthening of latex to prevent polymerize in depository tank of styrene, tank of padding with oxygen 5% through the tank.

Seed Latex

Seed Latex used by PT. DCI represent raw material of supporter made by our self by one of subsidiary company of Dow Chemical Company which have location in Australian. In consequence, size measure of particle latex yielded have the character of this homogeny matter and represent one of excellence latex which made by PT. DCI. Seed Latex function to control size measure of particle latex. More and more seed latex enhanced by into reactor hence size measure of particle latex formed smaller conversely.

Raw Material Support

Besides especial raw material, in making latex is also required by raw material of support which its amount is adapted for by recipe of each grade we made. Every product to be made Latex, raw

material used in making latex is functional monomer-monomer, initiator, chain transfer agent (CTA), surfactant, defamer/dispersant, antioxidant, Caustic for controller pH, biocide, chelating agent, and dispersing agent

Functional Monomer-Monomer

Functional Use Monomer-Monomer in making latex aim to form the specification of product the desired by consumer. As does the other raw material, its amount base on recipe for each product, every product to be made. functional type Monomer used by PT. DCI cannot be written down at this report because representing company secret. Functional Monomer used to be conducive to from outside the country and have capacities about 25 Kg.

Initiator

Initiator represent initiating functioning to start reaction of polymerize that this material there are have free radicals. Others, function of initiator is to stabilize particle of latex in colloid. Initiator used by PT. DCI supplied in tidiness of poke of have capacities 25 Kg. Packing of Initiator used the in form of powder.

Chain Transfer Agent (CTA)

CTA used by PT. DCI is compound of merkaptan in the form of melting. Its function shall be as follows " controlling weight molecule of yielded polymer "controlling strength, hardness, and the polymer elasticity" becoming the part of enchaining the polymer" discontinuing polymerize reaction.

Increase the CTA entered into reactor will influence weight molecule of polymer formed. More and more CTA enhanced hence smaller the weight molecule of yielded polymer. The tank of mercaptan padding with gas of nitrogen to prevent explosion effect of high temperature.

Surfactant

Surfactant enhanced in making of polymer function to take care of stability of latex and enlarge size measure of particle on latex when used in high concentration. Surfactant work by stabilizing particle of small latex (seed latex) before feeding, latex then stabilize particle of latex which is formed of a reaction. Stabilization conducted with mechanism, entangling surfactant ionic or with mechanism of stabilization entangling surfactant non ionic

Defoamer

Especial Function from deformer is to control forming foam during process of dissociation in stripper. There are two type defoamer, that is oil of base of defoamer and water of base defoamer. use of Oil base on defoamer have to be controlled better because content of silicon in this can generate effect " fisheyes" at film latex. So that have to be enhanced by deformer in activator. Nevertheless, defoamer of this type of better [of] [his/its] performance than water of base defoamer. While advantage of water of base of deformer [is] [do] not generate effect " fisheyes". Deformer used in making of latex [in] PT. DCI [is] water of base deformer

Antioxidant

Especial Function from antioxidant is to prevent the happening of oxidation at latex. This matter cause latex become more durable (lifetime latex become longer). Others of antioxidant also function to prevent brittleness latex moment used (Dubé et al., 2021)

Controller pH

Addition of controller pH into latex is to control pH of during reaction take place and after polymerize end (stabilization pH in stripper) (Tsakiridis et al., 2011). Addition of controller pH is also entered in adjusting tank to control pH latex as according to specification of product of the desired by consumer. Substance of Controller pH enhanced into adjusting tank is caustic soda or ammonia.

Chelating Agent

Chelating Agent function to eliminate ion of metal especially Fe2+ in order to latex yielded is not rust colored (Yetisen, 2014). This material have the character of reactive to initiator so that may not be united. Addition of this Iihat vitamin in number a lot of will influence pH

Dispersing agent

Dispersing Agent function for dispersion particle of easier latex in order to used for the application latex. All the raw material supply in drum tidiness, poke, and also supply by bulk (in isotank). Raw material supply by bulk then kept in depository tank of raw material. While raw material supply in tidiness of drum and poke kept in depository warehouse of raw material (Cockayne, 2020). As for way of settlement of depository raw material in bond shall be as follows " settlement of goods have to follow system " fifo" (first in, first out) so that there no raw material which expired " dating in each label of accepted raw material " goods improper wear have to be locked out of [by] a goods which still nicely and given by the label " settlement of raw material have to relate at reactive chemical chart

Step Process

First Process making latex cover from preparation phase, reaction, dissociation, adjustment, screening, refrigeration, and depository.

Preparation Phase

Preparation Phase conducted in two tank, that is aqueous tank and premix tank. This phase aim to form readily homogeneous mixture baited by into reactor. As for substance mingled in aqueous tank are surfactant, water, caustic soda, and initiator. While substance mingled in premix tank are surfactant, irrigate, caustic soda, steam, and chelating agent. addition Steam at premix tank aim to to heat mixture in it. So that energy required to reach slimmer reaction temperature

At this phase, extant substance of dilution conducted automatically, while extant substance of powder entered in manual (hand add) by operator. Substance amount entered by into the tank second base on product recipe which wish made.

Phase Reaction

React passed of semi-continue with a reactor of batch and require time during making product about 4-5 hours. temperature And operating pressure base on recipe of product to be made. In general, react to take place at temperature 85-102 Degree Celsius. All material entered into reactor like : monomer styrene, butadiene, functional monomer-monomer, mixture coming from premix tank and aqueous tank, and " seed" latex (seed latex Mixture from aqueous tank entered at the same time by monomer-monomer and chain transfer agent (CTA) with certain rate of flow slowly. Solution of mixture from aqueous tank entered from top of reactor, while monomer-monomer and CTA entered

from underside of reactor. Meanwhile, mixture from premix tank and seed latex entered at the same time from top of reactor directly.

Depository Phase

Latex which have been made cool latex then kept in depository tank (storage tank). Before entered into depository tank, specification of latex yielded in each batch analysed before transfer to ensure that in each of latex on spec. Every tank there are latex which of a kind different grade. Latex residing in in depository tank will be circulated every day to prevent formed latex skin. Dow Chemical Indonesia have 3 storage for carpet product and 8 storage for paper product, but not have dedicated tank for special both product.

Product Warehouse

Latex which have been pass quality, then sent to consumer in the form of isotank (23 ton), Schultz bin (1000 Kg), and drum (200 Kg). Basically making and packaging of latex conducted as according to consumer order. Packing of Latex usually using bulk/isotank is direct sent to consumer after admission filling of isotank finish. While tidy latex in drum or Schultz bin earn sent direct or kept beforehand depository in bond product as stock. Depository [of] product may not too old because can cause damage. Others of product one year conducted by a obstetrical inspection of bacterium at latex taken as stock. settlement of Product must be done by " fifo" (first in, first out), as like does the raw material settlement.

Fault Finding Interval - Example

During the past 1 year (360 days) there have the level transmitter were failed as required to be activated. Radar level transmitter at the existing for measure storage level have problem 16 times for 1 year between of the storage only 3 storage indicate fail. And the other storage running well as our requirement.

Fault Finding Interval - Solution

In evaluating the Failure Finding Interval the risk of multiple failures must be calculated.

Failure rate of the protected function for V-1000

The “Protected Function” in this storage are have failure. The functional failures and additional secondary damage occurs as data for V-1000 one year (360 days)

Fail = 6 times.

The failure rate (λ) = 1/(MTBF)

MTBF = Mean Time Between Failures

Data has identified sixteen faults in the past one year between eleven unit radar transmitter.

MTBF = Total Time in Service/(Number of Failures)

= (360 days X 24 H) / 6 failure

= 1440 Hours.

The failure rate (λ) = 1/1440 hours

= 0.000694

Calculating the Availability required.

Base calculation of MTBF at above the result is 1440 representative for vessel V-1000 as depend on data failure 2020.

$$\text{Availability} = \frac{MTBF}{(MTBF + MTTR)}$$

1440 hours Availability = ----------
1440 hours + 48 hours
1440 hours = ---------- = 0,967
1488 hours

Mean Time To Repair (MTTR) is the most common measure of maintainability. It is the average time required to perform corrective maintenance on all of the removable items in a product or system. This kind of maintainability prediction analyzes how long repairs and maintenance tasks will take in the event of a system failure.MTTR also factors in to other reliability and maintainability predictions and analyses. MTTR can be used in a reliability prediction in order to calculate the availability of a product or system.

Data from actual maintenance data base that average for one times repair for radar level transmitter is 8 hours.
For Vessel V-1000 = 6 fail * 8 hours = 48 hours

Calculating of the Reliability

The following gives MTBF impacts both reliability and availability. Before MTBF methods can be explained, it is important to have a solid foundation of these concepts. The difference between reliability and availability is often unknown or misunderstood. High availability and high reliability often go hand in hand, but they are not interchangeable terms. It is the likelihood that the system or component will succeed within its identified mission time, with no failures. An aircraft mission is the perfect example to illustrate this concept. When an aircraft takes off for its mission, there is one goal in mind: complete the flight, as intended, safely (with no catastrophic).

$$R(T) = e^{-\lambda T}$$

- (0,000696 * 24)
R (24) = e = 0,98
Reliability for one day (24) hours = 98%

Failure rate of the protected function for V-1010

The “Protected Function” in this storage are have failure. The functional failures and additional secondary damage occurs as data for V-1010 one year (360 days)
Fail = 7 times
The failure rate (λ) = 1/(MTBF)

MTBF = Mean Time Between Failures

Data has identified sixteen faults in the past one year between eleven unit radar transmitter.

MTBF = Total Time in Service/(Number of Failures)
= (360 days X 24 H) / 7 failure
= 1234 Hours.

The failure rate (λ) = 1/1234 hours
= 0.00081

Calculating the Availability required.

Base calculation of MTBF at above the result is 1234 representative for vessel V-1000 as depend on data failure 2020.

$$\text{Availability} = \frac{MTBF}{(MTBF + MTTR)}$$

1234 hours Availability = ----------

1234 hours + 56 hours

1234 hours = ---------- = 0,956

1290 hours

Mean Time To Repair (MTTR) is the most common measure of maintainability. It is the average time required to perform corrective maintenance on all of the removable items in a product or system. This kind of maintainability prediction analyzes how long repairs and maintenance tasks will take in the event of a system failure.MTTR also factors in to other reliability and maintainability predictions and analyses. MTTR can be used in a reliability prediction in order to calculate the availability of a product or system.

Data from actual maintenance data base that average for one times repair for radar level transmitter is 8 hours.

For Vessel V-1000 = 6 fail * 8 hours = 56 hours

Calculating of the Reliability

The following gives MTBF impacts both reliability and availability. Before MTBF methods can be explained, it is important to have a solid foundation of these concepts. The difference between reliability and availability is often unknown or misunderstood. High availability and high reliability often go hand in hand, but they are not interchangeable terms. It is the likelihood that the system or component will succeed within its identified mission time, with no failures. An aircraft mission is the perfect example to illustrate this concept. When an aircraft takes off for its mission, there is one goal in mind: complete the flight, as intended, safely (with no catastrophic).

$$R(T) = e^{-\lambda T}$$

- (0,00081 * 24)

R (24) = e = 0,98

Reliability for one day (24) hours = 98%

Failure rate of the protected function for V-1050

The “Protected Function” in this storage are have failure. The functional failures and additional secondary damage occurs as data for V-1050 one year (360 days)

Fail = 9 times.

The failure rate (λ) = 1/(MTBF)

MTBF = Mean Time Between Failures

Data has identified sixteen faults in the past one year between eleven unit radar transmitter.

MTBF = Total Time in Service/(Number of Failures)

= (360 days X 24 H) / 9 failure

= 960 Hours.

The failure rate (λ) = 1/960 hours

= 0.00104

Calculating the Availability required.

Base calculation of MTBF at above the result is 960 representative for vessel V-1000 as depend on data failure 2020.

$$\text{Availability} = \frac{MTBF}{(MTBF + MTTR)}$$

960 hours Availability = ----------

960 hours + 72 hours

960 hours

= ---------- = 0,93

1032 hours

Mean Time To Repair (MTTR) is the most common measure of maintainability. It is the average time required to perform corrective maintenance on all of the removable items in a product or system. This kind of maintainability prediction analyzes how long repairs and maintenance tasks will take in the event of a system failure. MTTR also factors in to other reliability and maintainability predictions and analyses. MTTR can be used in a reliability prediction in order to calculate the availability of a product or system.

Data from actual maintenance data base that average for one times repair for radar level transmitter is 8 hours.

For Vessel V-1050 = 9 fail * 8 hours = 72 hours

Calculating of the Reliability

The following gives MTBF impacts both reliability and availability. Before MTBF methods can be explained, it is important to have a solid foundation of these concepts. The difference between reliability and availability is often unknown or misunderstood. High availability and high reliability often go hand in hand, but they are not interchangeable terms. It is the likelihood that the system or component will succeed within its identified mission time, with no failures. An aircraft mission is the perfect example to illustrate this concept. When an aircraft takes off for its mission, there is one goal in mind: complete the flight, as intended, safely (with no catastrophic)

$$R(T) = e^{-\lambda T}$$

- (0,00104 * 24)

R (24) = e = 0,97

Reliability for one day (24) hours = 97%

Expectation Condition

Dow Chemical Indonesia many order from local or export to customer that product able to fulfill required demand plan to supply at least 100 MT / days that production facilities need to be maintained to meet level exactly reading actual. Planner will difficult to arrange product to customer when level

not reading accurately as the same between actual and reading MOD 5 (DCS). Maintenance effort to our goal as want to high reliability of the radar level transmitter. Preventive maintenance involves performing routine inspections, servicing and keeping facilities in good repair. These activities are intended to build a system that will find potential failures and make changes or repairs that will prevent failure. Preventive maintenance should be on target as refer to schedule to avoid radar level fail. It also involves designing technical and human systems that will keep the productive process working within tolerance, it allows the system to perform. The emphasis of preventive maintenance is on understanding the process and keeping it working without interruption.

Dow Chemical Indonesia have eleven tanks as 3 tank for carpet product and 8 tank for paper product, but all storage not for dedicated for special product, all product allow allocated for both the product. This research for special storage area level indicator as not properly function in normal operation. For improvement for increase performance every product storage performance level accurate. So that problem effect to delivery will late to customer.

Challenges and Obstacle

Commitment from maintenance team for to the job preventive maintenance for radar level transmitter product storage consistently as refer from scheduler daily activity. It is rather difficult to manage the schedule, because it will be conflict in interest between polystyrene plant and latex plant if any problem in the same time. Everyday scheduler will assign with maintenance team who will do to do preventive maintenance at polystyrene or latex plant. Dow Chemical Indonesia have manual book for guideline for solve problem manpower activities, but on emergency situation is difficult to take the best choice.

Build the team special for handle this problem as refer to Reliability Centered Maintenance (RCM) take from other function such as : Production, Maintenance, and Reliability engineer. But manpower will shortage to daily activity for handle two plant. Support from management to the team as needed for the team focus fix the situation. Can we do the job to get 100% reliability of radar level product storage transmitter such as other storage? Challenge!!!!

Analysis And Problem Solving

1. Analysis

In evaluating the Failure Finding Interval the risk of multiple failures must be calculated every product storage tank to know which are the tank have problem. On the data 2020 from 11 unit radar level transmitter not all the tank have problem. Only three product storage are identified. Below the calculation for three the tank.

2. Problem Solving

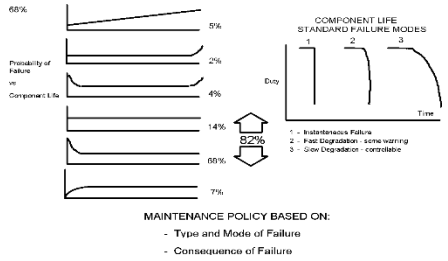
Table 1 Three storage tank calculation

Storage	Fail(times)	FR	MTBF(Min)	A	R(T(24))
V-1000	6	0.000694	1440	0,967	98%
V-1010	7	0.00081	1234	0,956	98%
V-1050	9	0.00104	960	0,93	97%

The benefit from current data that the team can do first priority and the team commit to follow role procedure maintenance.

CONCLUSION

Conclusion result from calculation for three storage have identify which are the storage level more monitor with the other tank. And Recommendation for all the tank to update preventive maintenance. Reliability Centered Maintenance is a strategy development methodology developed in the aircraft industry and now widely applied in improving the effectiveness of maintenance, increasing reliability and lifting performance. In a major study of equipment failure patterns, the United States aircraft industry found that, contrary to all expectations, over 80% of components failed randomly. There seemed to be no definitive life characteristics on which to base repair or replacement policy. With such a high proportion of random failures, aircraft engineers had to look elsewhere to find a practical basis on which to establish a maintenance policy. This led them to consider two important aspects of component failure - the time taken from fault identification to actual failure (degradation time) and the consequence of that eventual failure.



Picture 1 – 1 Typical component/ life failure pattern

If the consequence of an item failure is low and the rate of degradation is detectable, slow and controllable, then clearly the requirement to prevent that failure is low and it may well be sensible policy to 'operate to failure'. Conversely, if the item fails suddenly and with no warning and the consequence of that failure is high, then clearly prevention of that failure must be a high priority and will demand a quite different maintenance strategy. Whilst the proportion of components which have life dependent failure patterns (e.g. wear parts) will vary from industry to industry, the principals of Reliability Centered Maintenance are applicable to just about every industrial or mining application which involves the maintenance of capital plant and equipment. RCM offers a simple and most reliable way to implement these principles in the development of a Maintenance Plan. The most cost-effective maintenance strategy should be based on principles of reliability, formed on a premise that the best one could do is ensure that a component retains its inherent design reliability within a specific operating context.

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