

**DEVELOPING A COST EFFECTIVE
IN-HOUSE
FUGITIVE EMISSION PROGRAM
FOR HON COMPLIANCE**

Presented by
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at the
IBC Symposium for
HON Compliance
December 1997

Biography

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Buddy Joyner was employed at the Celanese Engineering Resins Bishop, Texas facility in March 1983 as an operator helper assigned to the plastics testing laboratory. After a two-year assignment he was transferred to the Nylon production unit for three years. Following the assignment to Nylon he was transferred to the Methanol Synthesis production area for four-years. After which time he was assigned to the environmental department as Fugitive Emission Coordinator.

Using the operation and mechanical experience that was gained from his previous assignments; he has engineered and managed the current fugitive emission program for the Bishop facility since 1993. In addition, he has been a valued resource for fugitive emission programs at other Celanese facilities as well as chemical and oil refining facilities throughout the U.S. and Mexico.

DEVELOPING A COST EFFECTIVE IN-HOUSE FUGITIVE EMISSION PROGRAM FOR HON COMPLIANCE

In the beginning, before man, there was no air pollution. As man came on the scene, one of the first things that he used was fire. Thus emitting carbons to the atmosphere. Man continued to evolve, and with this came more air pollution, from industry, automobiles and a better life in general.

The states and federal government realized that air pollution could not go on unchecked without bringing an end to mankind on earth.

In 1990 the Clean Air Act was passed, forcing a reduction to air pollution. Part of the Clean Air Act was what is known as Fugitive Emission Leak Detection and Repair. Fugitive emissions are vapors from volatile organic compounds and hazardous air pollutants that escape from mechanical devices such as valves, flanges, pumps and compressors that should be designed to trap the emissions.

The Clean Air Act brought about point source monitoring with portable analyzers to detect all emissions in VOC or HAP service in industry. Prior to portable analyzers, if you did not see, smell or touch it everything was great. The portable analyzers caused industry to rethink its' definition of what a leak is. In the early days of the Clean Air Act a 10,000 PPM emission was considered to be a leak and a repair should be made as soon as possible. As the regulatory agencies and industry evolved through the fugitive emission monitoring programs the leak rate and the repair time was shortened. Today a 500 PPM emission is considered to be a leak and a first attempt at repair must be made within 5 calendar days. Should the first attempt at repair be unsuccessful, every effort is to be made to make an effective repair within 15 calendar days from the time the leak was first detected.

What does all this mean to industry?

Record keeping, increased head count, increased repair cost, and the possibility of being fined by the state and federal agencies for violations. The reduction of emissions comes in last, because you are so busy being legal.

The cost associated with doing business and being competitive in a world market place does not allow industry to have the drain on the profits associated with a fugitive emission leak detection and repair program.

There are 2 ways to approach fugitive emission leak detection and repair program; Reactive and Proactive

- A reactive approach simply throws money at the LDAR program until compliance is achieved for the current monitoring period. At the end of the day,

Industry must decide if the value of reduced emissions gained from the program off sets the cost associated with it.

An average LDAR program will cost a facility with 70,000 to 100,000 components ~\$200,000 per year for monitoring alone. There will also be another \$200,000 for repairs. If this same facility could reduce their leakage by 20 tons per year, the cost would be \$20,000 per ton for the program. This would provide the facility with a basic LDAR program that meets all requirements.

Not much can be said for this approach. Just put your money down and spin the wheel. Things could get better, but most likely they will not.

❖ *A proactive approach to an LDAR program will not only meet the requirements, but also give you a program that should decrease emissions each year for 6 to 10 years.*

The proactive LDAR program is the approach that I have opted to use.

When the Clean Air Act required fugitive emission leak detection and repair programs, my facility chose to bring in a consultant to set up the program. About 20,000 components were identified for a monitoring program. These were identified with a 1 inch metal dog tag, and entered into the consultants' database.

So, we were off and running with an LDAR program to the tune of \$120,000. This program continued for about 4 years. Each time a new regulation was added a new dog tag was added to the component. Some components had as many as 4 dog tags representing 4 different regulations. As tags were lost new numbers showed up for that component. We found that about \$7,000 per year was being spent on replacing tags. This was not the fault of the consultant; it was the technology of the time.

New Software and New Tags

With the HON regulation approaching and the components to be monitored expected to at least triple, we decided a new leak data acquisition system should be purchased. This system would have to be designed with all current and future regulations in mind. Our objectives for this new leak data acquisition software were 6 fold:

- By having our own database we would have direct access to all monitoring records.
- The component leak history could be tracked and thus modified.
- We would have better control over reducing emissions by acting instead of reacting.
- Manpower to run the program could be reduced.
- Regulatory compliance could be assured.
- Cost of the program could be controlled.

Before these six objectives could be achieved, preparations had to be made to manage an in-house LDAR program. A tagging program was initiated for all components. We needed a tag that could be mass-produced for the initial tagging job, as well as individually reproduced whenever it was necessary to replace missing tags.

The cost of using the metal dog tags for this tagging job would have been ~\$125,000 just for tags. Instead, chose to create tags from two inch plastic disks that were actually waste products from our plastics laboratory! The total material cost for tagging the entire facility was \$36,000. A saving of \$89,000 was realized before our program even got started!

By completely tagging our facility, we were able to identify all components whether currently regulated or not. As new regulations are inevitable, we did not want to ever have to totally retag a unit.

All of our tag numbers are unique and in sequential order. This allows any individual at the facility to be able to locate a component without having to have any process knowledge. Should a tag be missing, it is immediately recognized and can be replaced.

The monitoring personnel are able to increase their daily component count by not having to search for the next component. By increasing the daily component count, our manpower savings was 8 days per quarter. This equates to a savings of \$12,000 per year.

Starting the new LDAR Program

Populating the database was the next major task to undertake. It was originally estimated to take 120 working days to accomplish this task. Due to the capabilities of the leak data acquisition software we chose to use (ORR LEAKDAS), the entire facility's population of components were entered into the database in just 60 days. A savings of \$13,000 was realized from this effort. Populating the database could have been done for less money by using a clerical type person rather than our fugitive emission coordinator, however, a vast amount of process knowledge was gained from performing this task. This knowledge has paid huge dividends over the past 4 years. The fugitive emission coordinator has a very good understanding of all process units and why components need to be monitored or why they should be exempted from various monitoring regulations. It was great training.

After the database was populated, the next step was to begin the collection of data. We started entering data the second quarter of 1993. At that time, we were still using the consultant to do our entire program. We duplicated the consultant's data in our database in order to be sure that everything was working correctly. We did this because the leak data acquisition system we had just implemented seemed to good to be true.

In January 1994, we put the new database software into full service. The consultant still provided the manpower for monitoring, but all the data was collected and stored on our equipment and software. We were monitoring about 70,000 components at a cost of \$60,000 per quarter. We also were

running a 10% leak rate on combined component types. Because the consultants did not do repairs, we estimated the total cost of repairs to be \$245,000 for that year.

Data Management & Analysis Leads to Cost Saving Discoveries

During 1994 and 1995, the leaks fluctuated up and down each quarter. By using the monitoring data that was being collected and the reporting capabilities of the database, I was able to easily see that 54% of our leakers had failed more than 1 time. After evaluating the leak situation it was decided that the approach to take was a full scale attack on the repeat leaks.

The leak data showed that after we had tightened bolts and packing numerous times, the leak would stop for a period of time then start again. Leaks were also reoccurring on valves that were repacked and on flanges that had new gaskets. By using the software to compare the leaking components to each other, some common links began to appear.

There was one common chemical in many of the components. We found that if this particular chemical was near a 50% concentration, tightening packing or flange bolts was a futile effort. A leak would reoccur within days. New packing and new gaskets did not perform a lot better. We found that a repacked valve that was in other wise good condition could be expected to leak within 6 months. We had to do something, but what?

- Valve and packing manufactures were contacted with very little success. Everybody makes the latest and greatest product on the market. You can tell, because it says “environmentally safe” right on the product.

The manufacturer’s test data was not very helpful. Our plant primarily manufactures chemicals and all the test data available was for the refinery industry. We decided to do our own compatibility test, so I put 3 bottles of this chemical at 50% concentration on my desk. Every manufacturing rep was told to put a sample of his product in the bottle and come back in a few weeks. The results ranged from instant disintegration to no effect at all.

- We then took samples of the compatible materials and repacked valves in the field that we knew to be repeating leakers. This test narrowed the selection down to 2 products. One of the products was a very expensive

material, while the other was more in line with the price we had been paying for packing.

While this study of packing material was going on, we experienced an unusual weather phenomenon. In January of 1996 we had 8 freezes back to back. Since South Texas temperatures are normally in the high 80's and 90's this cold weather caused the packing material to contract. Our leakers jumped up tremendously. After making a lot of phone calls we found that other plants were experiencing the same increase in leaks due to cold temperatures. With this knowledge another experiment was conducted.

- We took 2 valves in identical service that was known to have repeating leakers. Our valve repair crew was called out and instructed to pack valve "A" in the normal manner. The normal manner was to fill the packing gland with rings of packing and then tighten the packing follower down until it was tight. A different method was used on valve "B". Only 5 rings of packing was put in the packing gland, and then "Belleville" springs (convex washers) were put on the packing bolts above the follower. 21 lbs. of torque was then applied to the nuts. Both valves were monitored daily with our fugitive emission analyzer.

Valve "A" leaked 2,000 PPM within 7 days, while valve "B" remained at 0 PPM. While this test was going on we did not experience any freezing weather, but we felt confident that the "Belleville" springs were keeping a constant pressure on the packing.

- This packing technique with "Belleville" springs was used on 50 other valves that had been repeat leakers.

During one year of service these valves did not leak again. Only 2 of the 50 valves had even a trace reading during the year.

In January of 1997 we again experienced the freezing weather, and again we had an increase in our leakers. However, the valves with the "Belleville" springs did not leak.

It should be noted that the "Belleville" springs are not a cure all or we would have put them on every valve in the plant. The "Belleville" springs technique works well with low vapor pressures on material with a low density.

The LDAR Program as a Resource for Decision Making

- As our database history and leak tracking capabilities for individual components has increased, the knowledge has been passed on to other areas of the plant.

Our process and mechanical engineering groups are now using this information when new or rework designs are being made. By using this information, it is our goal to have zero leaks for up to 10 years for all new and reworked components.

- Our purchasing procedures are much the same as everyone else in industry. “If a component meets the ANSI standards, go for the least expensive equipment.” This philosophy does not work well with fugitive emissions.

Since everyone today should be complying with Phase 3 of the HON requirement, it is obvious that a 500 PPM leak definition does not give you much room to work. In looking into our leaking valve situation we found that even though a valve meets the ANSI standards, it may not be the valve to use. We have selected one valve company that can supply consistent quality to meet our needs.

Due to the amount of time it has taken to research all aspects of what we are calling a “Quality Improvement Program” I cannot claim a drastic reduction of leakers. Due to economic restraints we could not just throw out everything we previously had and start over. We have implemented a replacement program that will, over time, replace valves, packing and pump seals with the recommended types.

As great as I feel our repair program is, the initial collection of data is what makes it all work.

Confidence in the System Led to More Cost Saving Initiatives

- As of January 1, 1997 we went to an IN-HOUSE fugitive emission program. As the cost of using a consultant continued to climb each year, we were able to justify supplying and training our own labor force to conduct the monitoring program.

We spent about 2 weeks of classroom training where we covered Method 21, state and federal fugitive emission regulations and reading and understanding piping drawings. Another 4 weeks was spent in the field doing actual monitoring alongside the consulting crew.

By providing our own labor for the monitoring portion of the LDAR program we are going to save \$154,000 in 1997.

- Along with providing the labor for monitoring, one of the monitoring crew members has 15 years experience in valve repair. This individual makes all first attempts the day that a leak is detected. He has been 80% successful in stopping our leaks with a first attempt (a major labor savings). Of the remaining 20%, he is able to do an effective repair within 15 days on 10% and the other 10% have to be scheduled for a unit shut down.

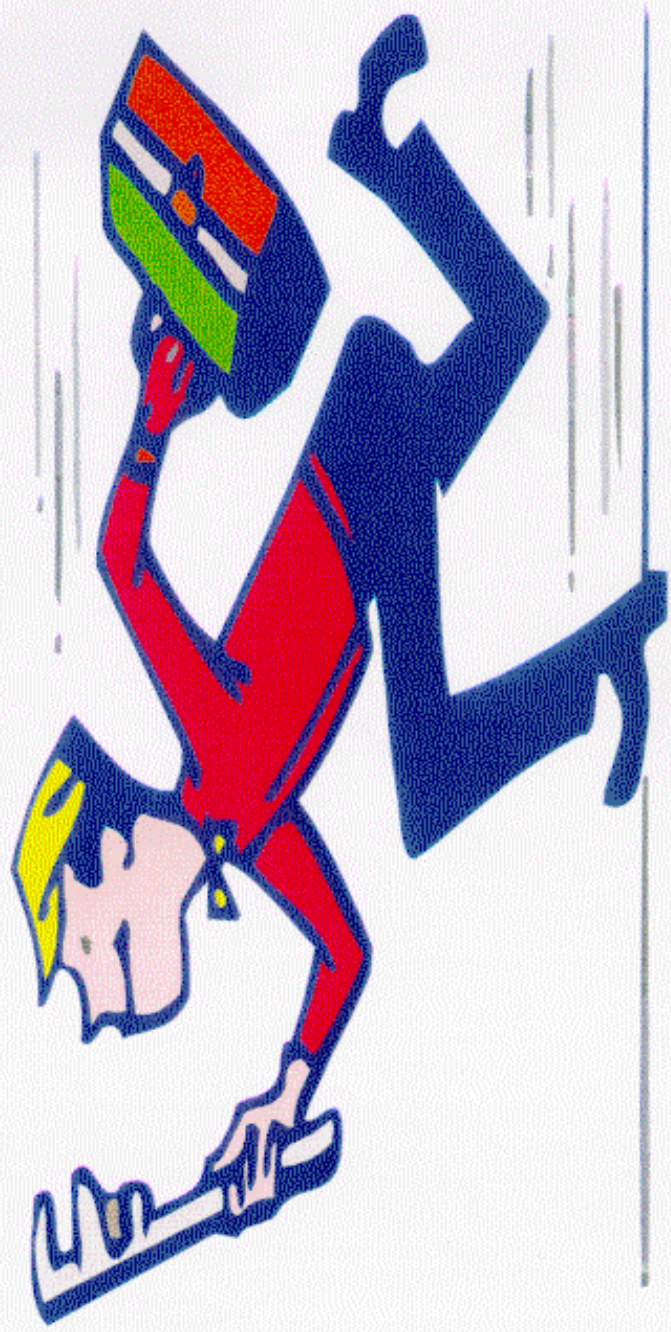
For the first 6 months of 1997, we estimate a repair savings of \$125,000. Along with the dollar savings, we have peace of mind from knowing that all repairs were made on time.

Establishing a Proactive LDAR Program

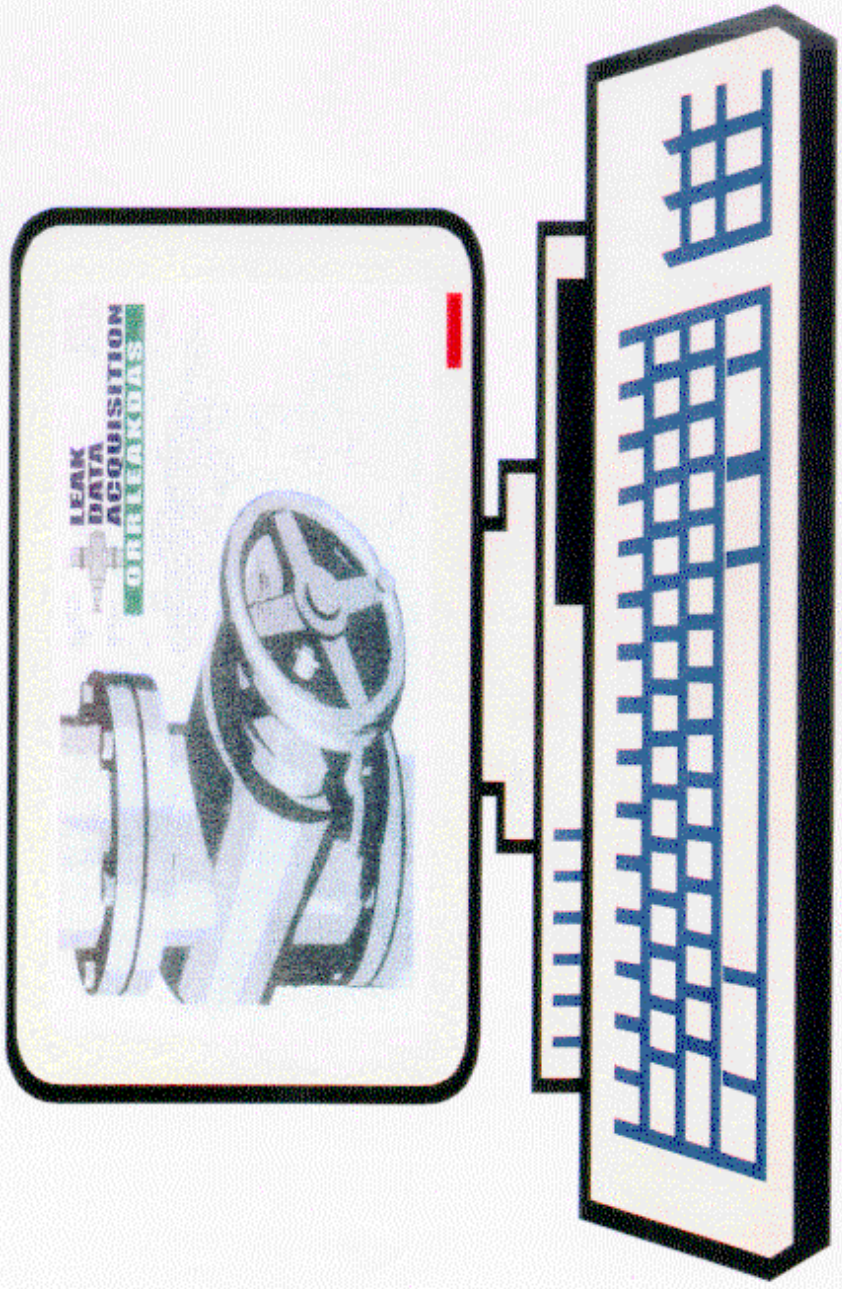
The collection of data is a preamble to a successful LDAR program. However, without doing an analysis of the data, you will always be in a reactive mode. Operating reactively will never allow you to realize any cost savings for your program. Find what will work best for your situation and make a commitment to continually improve based on the data collected. Bench mark your activities and set long and short-term goals for improvement.

In closing I would like to use a phrase coined by the computer industry in the 60's; "Garbage in - Garbage out". First, your LDAR program needs accurate and reliable information in order to produce the results you want. Data integrity is fundamental. Secondly, the software you or your consultant uses to manage your LDAR program needs to process and present the information in sufficient detail to help you make strategic and tactical decisions.

A PROACTIVE LDAR PROGRAM
WILL REDUCE EMISSION
AND MEET ALL REQUIREMENTS



WITH THE LEAK DATA ACQUISITION
SYSTEM POPULATION OF
THE DATABASE
TOOK HALF THE TIME EXPECTED



THE LEAK DATA ACQUISITION
SYSTEM SEEMED
TOO GOOD TO BE
TRUE



**KEY INGREDIENTS
FOR A COST
EFFECTIVE
AND SUCCESSFUL
HON LDAR
PROGRAM**



**ACCURATE FIELD
INFORMATION**



**EFFECTIVE
REPAIR AND
RECORDS**



**HISTORICAL DATA
AND ANALYSIS**