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TO: Mr. L. L. Reynolds

FROM: R. H. Jones

SUBJECT: Lead Contamination Study - TEL Area

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Introduction

A study was begun in February, 1966 to determine the sources of lead contamination in the TEL area and to determine what steps should be taken to reduce the contamination hazard. The purpose of this report is to summarize the information obtained to date and to recommend steps to reduce the lead contamination hazard. Background information is filed in "1966 Air Contamination" file.

Particular emphasis during this study has been placed on the lead contamination problem in "C" Manufacturing Building, where contamination is most severe. Some studies have also been done in "B" Building and in the alloy area.

The principal sources of lead contamination which have been discovered are listed below along with suggestions for eliminating or reducing the lead concentration in operating areas.

A list of recommendations is included at the end of this report.

"C" BUILDING

5th Floor

1. Alloy Hoppers - Spot air samples underneath empty hoppers on the 5th floor and in the tunnel averaged 1.27 mg/ft.^{3} (Target maximum concentration is 0.002 mg/ft.^{3}) There is also an indication that northerly winds cause contamination on the 5th floor by blowing into the building through the opened doors at the north end of the 5th floor, thereby picking up lead vapors from the empty contaminated hoppers which are stored there.

   Liquid has been observed underneath empty hoppers on the 5th floor and in the tunnel on numerous occasions.

A system has been designed for purging the hoppers with nitrogen while alloy is charged to the autoclaves. This should prevent contaminated vapors from entering the hoppers from the autoclaves, thereby reducing the contamination from empty hoppers. Installation of this nitrogen purge system should be expedited.

2. Communication from 4th Floor - Air currents upward from the highly contaminated 4th floor near the walls was found to be a major source of contamination on the 5th floor. It was also found that peaks in lead concentration occurred on the 5th floor during the discharge portion of the autoclave cycle, i.e., when the angle valves and slide valves are open. Also, the lead concentration on the 5th floor was highest when highly contaminated work was being performed on the 4th floor, e.g., Duraseal repairs and unplugging drop legs.

   Communication from the 4th floor to the 5th floor has been reduced significantly by minor modifications which were made to the ventilation system in April. A portion of the supply air to the 4th floor was blocked off and the doors at the north end of the floor have been closed to create a greater downdraft of air from the 5th floor. These modifications have increased the difference in lead concentration between the 4th and 5th floors which has reduced the contamination level on the 5th floor.

   This is illustrated in Figure 1, "'C' Building Lead Contamination." However, some communication still exists and it may be necessary to isolate the 5th floor from the 4th floor by installing a partition between the edges of the 5th floor and the building wall. This will not reduce the contamination on the 4th floor but should reduce the contamination on the 5th floor, which is the more inhabited operating area.

3. Disc Ruptures - Lead concentration on the 5th floor of "C" Building averages 0.003 mg/ft^3 greater on days when disc ruptures occur at "B", "C", or "D" Buildings than on days when there are no disc ruptures. One set of spot samples obtained in "C" Building following a TML disc rupture showed that a short period (less than 30 minutes) of very high lead concentration followed the disc rupture. As shown in Figure 3, "Lead Concentration in 'C' Building Following Disc Rupture on C-17 Autoclave", lead concentration decreased rapidly from a very high level immediately following the rupture. The concentration then decreased gradually until the ruptured disc was removed from the disc line. At this time, the concentration increased rapidly to a very high level as a result of the hot vapors from the autoclave rising to the 5th floor when the disc flange was opened.

Additional data will be obtained following future disc ruptures.

4. Alloy Charging - Spot air samples indicate that little or no contamination occurs during charging. This is probably due primarily to the highly efficient charging head air exhaust system. Nitrogen purging of the hoppers as discussed previously should reduce any contamination which might occur during charging.

5. Charging Vent Valves - Packing glands on the charging vent valves (1 1/2") fail periodically which causes some contamination. Six such failures were repaired in February, and five were repaired in March. These leaks could be eliminated by replacing the existing valves with ball valves.

4th Floor

1. Plugged Drop Legs - The biggest cause of lost charges and one of the largest contributors to building contamination is plugged drop legs. Plugged drop legs account for nearly 100 lost charges per month which is equivalent to a 2% loss in production capacity. It is frequently necessary to remove the inspection flange from the drop leg to apply fire water pressure to force the plug out of the drop leg and into the still. This is frequently followed by mechanical cleaning of the drop leg. Lead concentrations of 0.02 mg/ft.^{3} or greater are common for the 4th floor on days when plugged drop legs are cleaned based on 24-hr. air analyses. Peak concentrations are probably much higher.

   A test is currently in progress in which the drop leg on C-2 autoclave is being water-flushed before and after each discharge of the reaction mass from the autoclave. The drop leg on C-2 autoclave plugged with an average frequency of 0.85 times per week during the period of January thru March. This pluggage rate has decreased to an average frequency of 0.24 times per week since the water-flushing was begun in April. This test will continue. Water-flushing was recently begun on two additional drop legs.

   A teflon-coated drop leg has been purchased for installation and trial in TML service in "D" Building. The "non-stick" characteristic of teflon is expected to reduce the pluggage frequency.

2. Duraseal Failures - Duraseal failures are another big source of lost charges and lead contamination. Duraseals have been replaced in "C" Building at the rate of eight per month for the past three months. Maintenance is currently looking into a modified seal design to reduce the number of failures.

3. Disc Ruptures - The lead concentration on the 4th floor following a disc rupture appeared to follow the same profile as the concentration on the 5th floor which was discussed previously. This is illustrated in Figure 3. Although the concentration profiles were similar for the 4th and 5th floors, the concentration on the 4th floor was 5 to 20 times higher than the concentration on the 5th floor.

Normally a ruptured disc is replaced by two pipefitters. It has been observed that on two occasions the pipefitter who removed the flange bolts and ruptured disc wore a fresh-air mask. However, the other pipefitter who stood beside the autoclave to assist wore no respiratory safety equipment. Both men should be required to wear fresh-air masks due to the very high lead concentrations which can be present. Lead concentration beside the autoclave was measured at 0.368 mg/ft.^{3} when the ruptured disc was removed.

4. Angle Valve - Slide Valve Assembly - Spot air samples from the 4th and 5th floors have shown that peaks in lead concentration occur when autoclaves are discharging to the stills. There are numerous points on each angle valve and slide valve where leaks can develop such as packing glands, grease tubing connections, fittings, and valves, pet cocks, flanges, cover plates, drain plugs, and water flush valves. These points are not exposed to autoclave pressure and hence cannot be leak tested as are the flanges and valves in the piping associated with the autoclave.

5. X-mas Tree Valve Cluster - Packing gland leaks occur frequently on the methyl chloride rear feed valves, nitrogen valves, primary vent valves, and methyl chloride feed control valves. The nitrogen valves are currently being converted to ball valves and relocated to the 5th floor. The rear feed valves and the primary vent valves could be converted to ball valves thus eliminating packing gland leaks. However, any resulting reduction in lead concentration on the 4th floor would probably be insignificant in comparison with the contamination which is caused by the items listed previously.

3rd Floor

High still pressure caused by back pressure from the old TML recovery system (AB-5) was formerly the primary cause of contamination on the 3rd floor. This contamination has been greatly reduced since operation of the new TML recovery system (AB-9) began on April 3. This improvement is shown in Figure 1. Since start-up of AB-9, the lead concentration on the 3rd floor has averaged only 0.0017 mg/ft.^{3} greater than

the supply air to "C" Building, excluding days on which disc ruptures or emergency vents occurred.

Spot air samples obtained with AB-9 operating indicate that little if any leakage is occurring at the Sylphon seals on the stills or at the flush-out connections on the still receivers.

Elevator - The elevator in "C" Building is highly contaminated by the empty hoppers which it transports. The lead concentration inside the elevator has averaged 0.03 mg/ft.^{3} based on results from the 24-hr. sampler installed April 29.

The nitrogen purge system for the hoppers should reduce this concentration. The lead level inside the elevator will be monitored to determine whether the concentration is reduced significantly after installation of the nitrogen purge system.

Tunnel - "C" Building tunnel is contaminated at least partially by empty hoppers which are stored at the north end. A 24-hr. sampler installed inside the south end of the tunnel averaged 0.016 mg/ft^3 during a recent 9-day period with northerly winds. "C" Building supply air averaged 0.005 mg/ft.^{3} during the same period. There is a strong possibility that a part of the contamination of the building supply air which occurs with northerly winds comes from the tunnel. This conclusion is supported by the fact that the lead concentration in building supply air has not dropped significantly since AB-9 began operation even though lead losses from the still exhaust have been markedly reduced. Therefore, the lead contamination in the supply air apparently originates from some source other than the building exhaust system. The lead concentration in the tunnel and in the supply air will be monitored to determine whether the concentration is reduced after installation of the hopper purge system.

"B" BUILDING

5th Floor

1. Alloy Hoppers - Liquid has been observed, along with particles of alloy, on the charging head slide plates and on the floor. A sample of this material was collected, extracted with toluene, and analyzed chromatigraphically. Trace quantities of TEL and TML were found. This TML may have entered the hoppers when they were in TML service in "C" Building. If this is the case, nitrogen purging the hoppers in "C" Building could reduce the contamination on the 5th floor of "B" Building.

2. Communication from 4th Floor - A portion of the supply air to the 4th floor was blocked off as was done in "C" Building in

The preliminary indication is that this did not reduce the lead concentration on the 5th floor. The contamination pattern on the 4th and 5th floors is shown in Figure 2, " 'B' Building Lead Contamination."

4th Floor

1. Plugged Drop Legs - Plugged drop legs are the biggest cause of lost charges and are a major source of contamination in "B" Building as they are in "C" Building.

   Water-flushing should reduce the number of pluggages as should installation of teflon-coated drop legs.

2. Duraseal Failures - Duraseal failures are infrequent and are therefore little cause for concern. Only one failureoccurred in April.

3rd Floor

The lead concentration averages only 0.003 mg/ft.^{3} on the 3rd floor. Therefore, no investigation was made there.

Supply Air

The lead concentration in the supply air to "B" Building nearly always analyzes lower than the supply air to "C" Building. One reason for this appears to be that a portion of the lead in "B" Building supply air is TML, which is not efficiently absorbed by the single-scrubber TEL sampler on the supply air to "B" Building. This TML, therefore, escapes detection. Supply air to "C" Building is sampled by a double-scrubber TML sampler which absorbs virtually all of the TML present in the air.

A double-scrubber TML sampler was installed alongside the existing single-scrubber TEL sampler on "B" Building supply air. The lead concentration as measured by the TML scrubber averages about 0.001 mg/ft.^{3} higher than that measured by the TEL sampler. This indicates that the lead concentration within the building may be slightly higher than that detected by the existing TEL samplers.

Alloy Area

The lead concentration in the alloy area is normally fairly low. However, spot samples show that organic lead concentrations as high as 0.076 mg/ft.^{3} occur at the graphite addition platform when an empty hopper is positioned for graphite addition with the slide valve open. Nitrogen purging the

hoppers while charging alloy to the autoclaves may reduce this some. However, the operator who adds graphite to the hoppers should continue the current practice of wearing a fresh air mask during the graphite addition step.

RECOMMENDATIONS

The following recommendations are made for reducing the lead contamination hazard in the plant.

1. The nitrogen purge system for the alloy hoppers in "C" Building should be installed as soon as is practicable.

2. Design and estimate the cost of a water-flush system for all 18 drop legs in "C" Building. Meanwhile, continue the water-flush test currently in progress.

3. Install a teflon-coated drop leg in TML service in "D" Building. This drop leg has already been purchased and received. If the unit performs satisfactorily, install teflon-coated drop legs in "B", "C", and "D" Buildings as it becomes necessary to replace existing units due to insufficient wall thickness which has been found on some of the units. Teflon-coating adds only $100-125 to the cost of a new drop leg.

4. Attempt to improve the service factor of Duraseals in TML service.

5. The communication between the 4th and 5th floors in "C" Building should be further reduced. This may be accomplished by blanking the area between the edges of the 5th floor and the building wall. The need for this cannot be determined until the 5th floor lead concentration is monitored after installation of the hopper purge system.

6. The 4th floor of "C" Building will continue to be highly contaminated even though the number of plugged drop legs and Duraseal failures may be reduced. This is due to the large number of potential leak sources, the high volatility of TML, the cyclic nature of the process, and contaminated maintenance work such as replacement of ruptured discs and repairs to slide valves, angle valves, and methyl chloride feed control valves.

   This contamination can be contained and restricted to the 4th floor which is not a prime operating area. However, if it is deemed necessary to eliminate contamination on the 4th floor it will be necessary to construct enclosures around the autoclaves. Field tests with enclosures around C-13 and C-14 autoclaves indicate

that properly designed enclosures are virtually 100% effective in containing contamination which originates inside the enclosures.

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