Monsanto

FROM (NAME & LOCATION) G. G. Quirk - I.O. - Ext 2378

DATE October 20, 1983

SUBJECT GASKETING TASK FORCE FINAL REPORT

REFERENCE

TO E. F. Celette

CC: D. R. Collette, K. A. Collins, R. J. Frey, D. R. Frikken-CS7H, P. J. Hamer, K. W. Howes, T. M. Jordan, W. W. Mowry, T. D. Pilarcik, C. P. Strzepa, W. A. Sitnik, D. E. Witwer, A. J. Zoglio, GGQ - File

SITUATION

Six spills occurred over a period of three months time, each of which involved failures of gasketed pipe joints, leading to uncontrolled releases of flammable chemicals. A task force of Plant Engineering personnel was assigned to investigate and determine if there was commonality in these incidents and to define appropriate corrective action. The scope of the group's investigation included the nine incidents that occurred through August 1983 and the documented incidents of 1982.

CONCLUSIONS

1. Each incident can best be described as a gasketed joint failure rather than a gasket failure.

2. Skills and practices in joint assembly were a major factor in the failures.

3. There is an apparent lack of understanding of the need to correct known hydraulic hammer problems that routinely overpressure piping systems.

4. The use of a gasket with built-in blowout protection, in most of the cases, would have significantly reduced the quantity of fluid released.

5. The physical components of many gasketed pipe joints throughout the plant do not meet current Monsanto piping standards.

6. The form of the current CED master pipe specifications does not provide the operating plant with a useable standard or guide.

7. Many compromises are being made in new installations and maintenance of piping systems as a result of #6.

BACKGROUND

There have been major philosophical changes in social attitude, in industry (ANSI) and within corporate Monsanto that have set the stage surrounding these events.

The change in social awareness and attitude toward the environment has precipitated legislative controls on how well the industry will perform in the containment of hazardous materials. Revisions to the ANSI code for Chemical Plant and Petroleum Refining Piping in 1973 and 1977 triggered a major revision in the format and content of the Monsanto Piping Manual. Monsanto

The following table was prepared to show comparative data of each incident and identify the involved and not involved factors.

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FINDINGS

Referring to each column or combination of columns of the accompanying table, the following information is apparent:

1. In column #1 - Department; 8 out of the 9 situations occurred in South Butvar operations.

2. In column #2 - Service; all involved chemicals are organic solvents with flash points well below 100°F and identified as Class I flammable fluids.

3. In column #3 - Gasket; all involved gaskets were made of 1/8 inch thick Garlock 900 or JM-61 sheet gasket material. These materials are white chrysotile asbestos with SBR binder - essentially equivalent and mutually substitutable. The current supply, fabrication and storage practices involving these gaskets were investigated and no discrepancies were found. The manufacturer's recommendation is "prime general service"; "preferred" for steam, water and salt solutions; "satisfactory" for mild acids and alkalies. Although not specifically recommended, the manufacturer states there is no compatibility problem with these solvents; however, no blowout protection is provided with the use of any plain sheet gasket. Our experience bears this out and the team's conclusion was: "When used in a correctly fabricated, well designed, properly assembled joint, this gasket is not a problem in this service but has limited capability in range of operating conditions."

   Inspection of the available failed gaskets from the incidents revealed a section missing in each case. Also, descriptions by the involved personnel at the time of repair support the same failed gasket condition in the other incidents. This condition indicates significant overpressure and/or inadequate seating pressure. Under these conditions, any gasket would leak; however, blowout protection would limit the incident to a small leak.

   Monsanto piping standards specify piping component group B for use with Class I flammable fluids. The involved gasket does not meet this specification, which basically says blowout protection and fire resistance must be included in the gasket design. In each of the near miss incidents, many gallons of flammable liquids were spilled unrestricted into the operating area. This situation presents a very high exposure level of an explosive mixture and a substantial amount of fuel readily available to an ignition source. With all the same circumstances but with a gasket having blowout protection, the spills would be reduced to small leaks; the exposure risk reduced substantially.

4. In column #4 - Joint Accessibility; 4 out of 9 situations were complicated by severe access problems. Although piping systems cannot always be designed with joints positioned in readily accessible areas, many problems canbe eliminated if more attention is paid to designing for operations and maintenance access. The vinyl acetate charge nozzle on PK#1 in South Butvar is a classic example.

5. In column #5 - Joint Fabrication; 1 out of the 9 situations was positively identified to have flange misalignment. Visual inspection of an additional sample of flanged joints in the involved headers revealed many cases where flange misalignment was involved in the resulting joint assembly.

FINDINGS (Continued)

9. In column #8 - Multiple Gaskets; 2 out of the 9 situations involved double gasketing. Further field surveys on the involved pipe headers show that multiple gasketing is employed in many places. Discussions with concerned personnel show that there is lack of understanding of the capacity derating resulting from this practice. In fact, this practice is considered an "acceptable fix" to field piping misalignment and short falls in fabrication.

10. In column #9 - Contromatics Flanged Valves; 6 out of the 9 situations involved a flanged joint at a Contromatic C-series flanged ball valve. The significance of this is that the C-series valve presents a very difficult bolting arrangement to make up the joint. The clearance between the valve body bolts and the flange bolts is severely limiting and, with the 3" and 4" size, impossible to enable proper flange-bolt installation using heavy hex head nuts and standard length bolts. This problem was reviewed by the team with the valve supplier and manufacturer. Their response was a new Triseal unit that will improve this condition in future installations. A new plant standard for ball valves was issued 9/1/83 which addresses this Contromatics flanged ball valve problem for future installations.

11. In columns #10 - Automated or Manual Valve, and #11 - Overpressure; all of the same 6 out of 9 situations are involved as in Finding #10. Wherever automated valves are identified, hydraulic hammer is the involved mechanism that initiated the spill. Likewise, wherever manual valves are identified, thermal expansion is the involved mechanism that initiated the spill. Both conditions are correctable through improved design by controlled, soft valve shut-off, shock absorption and relief protection. Additionally, in similar physical conditions, spills can be reduced to small leaks through gasket design that includes blow-out protection.

12. In column #12 - Standard Operating Conditions; 7 out of 9 incidents occurred during routine operations (uptime). Four of those 7 situations were routinely operating with severe hydraulic hammer, a seriously detrimental and intolerable operating condition. The instantaneous pressure development of hydraulic hammer is a direct function of the abrupt change in fluid velocity and the surge wave velocity in the system. Pressures in excess of 500% are easily obtainable along with significant resulting damage. Pipe line and weldment rupture, shearing of bolts, destruction of hangers, metering devices and instrumentation, in addition to ruptures of gasketed joints, are not uncommon resulting effects. It was the team's assessment that there is an acceptance of "living with" hydraulic hammer problems in piping systems. In fact, the joint on the vinyl acetate charge line on PK #1 in South Butvar has failed repeatedly over a period of years as a result of known hydraulic hammer in the charge systems.

13. A review of the five documented incidents of joint failures in 1982 was made. (Refer to the 1982 table on the following page.) Three of the five involved rupture of the gasketed joint caused by expansion of frozen contents. One incident involves the exact same equipment, pipe and joint, as NM #10-83 and NM #44-83 - hydraulic hammer on the automated vinyl acetate charge line to #1 poly kettle in South Butvar. The last incident involved reuse of damaged gaskets to swap blanks and enable dumping of a caustic wash on #5 kettle in Resimenes, Building 81.

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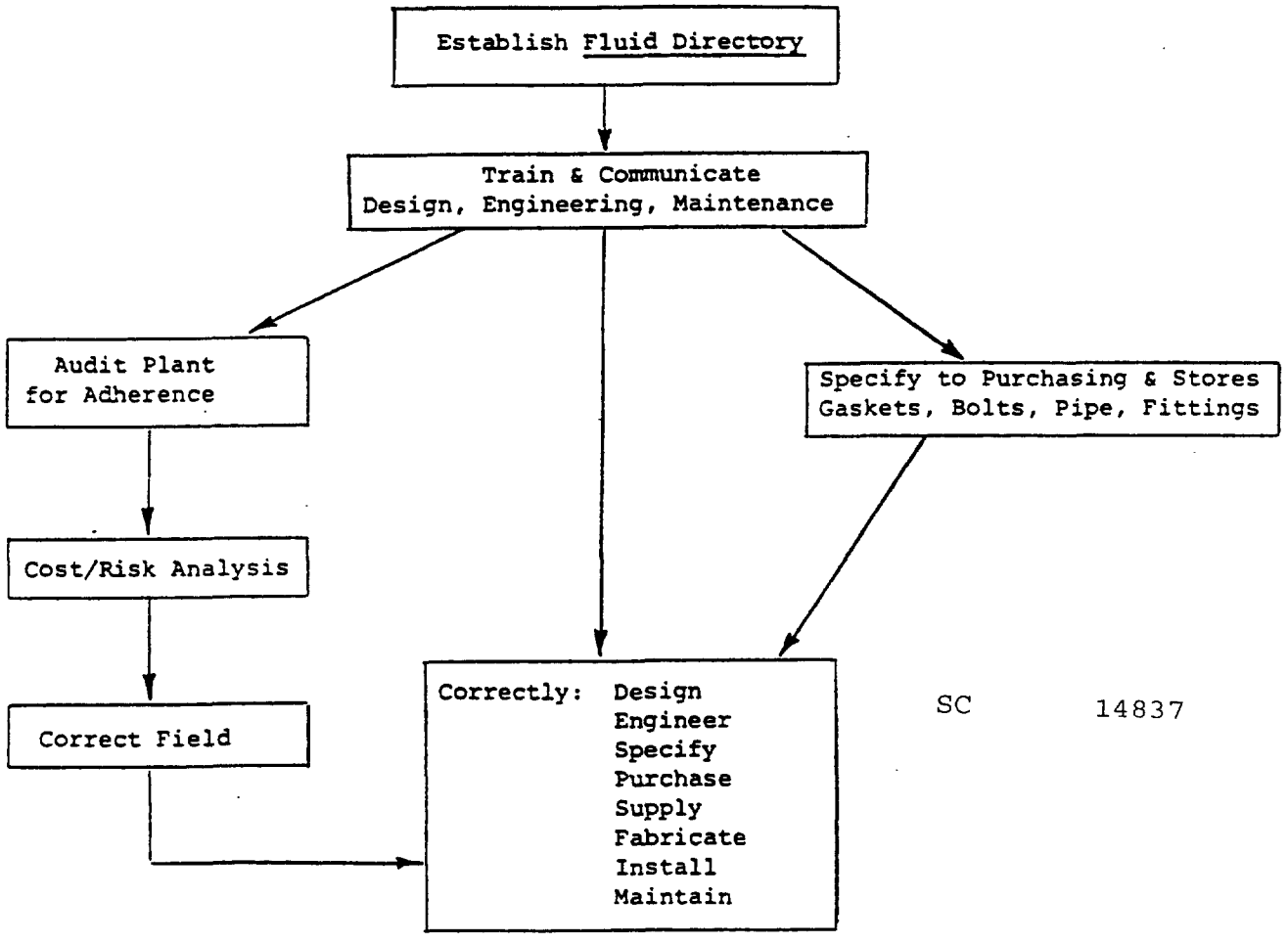
RECOMMENDATIONS

1. Complete the development of a Fluid Directory for each fluid service at the Indian Orchard site. This Directory will apply CED master pipe specifications to plant applications and define gasket, fasteners, and flange construction for future installations. In addition, alternate gaskets compatible with Monsanto standards, will be specified for existing plant pipe systems where installed hardware limits application. (In the interim, while the Directory is being developed, every effort should be made within Plant Engineering to consult knowledgeable personnel when pipe systems are specified.)

   Responsibility: Project & Maintenance Engineering Supts.
   Timing: March 31, 1984

2. Develop a program to train designers, engineers and maintenance personnel in the proper use and adherence to the Fluid Directory.

   Responsibility: Project Engineering Supt.
   Timing: May 31, 1984



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RECOMMENDATIONS (Continued)

8. Audit C-series Contromatic flanged valve installations in the known problem areas of Class I flammable fluids for bolting interferences and incorrect fastener size. Correct all cases.

   Responsibility: General Manufacturing Supts./Plant Engineer
   Timing: February 28, 1984

9. Investigate all known cases of hydraulic hammer. Provide shock absorption and/or soft shut-off to eliminate overpressure condition.

   Responsibility: General Manufacturing Supts.
   Timing: December 31, 1983 & Continuing

10. Investigate all known joint leaks for thermal expansion. Provide pressure relief protection or eliminate isolation potential.

    Responsibility: General Manufacturing Supts.
    Timing: December 31, 1983 & Continuing

11. Resensitize Engineering, Design and Maintenance personnel to the design requirement for potential overpressure through hydraulic hammer and thermal expansion on manual and automated 90° valved systems.

    Responsibility: Plant Engineer
    Timing: December 31, 1983

12. Communicate the findings of the Gasketing Task Force to all Plant Engineering and Manufacturing personnel, CED and S&PP Departments.

    Responsibility: All General Supts.
    Timing: December 31, 1983

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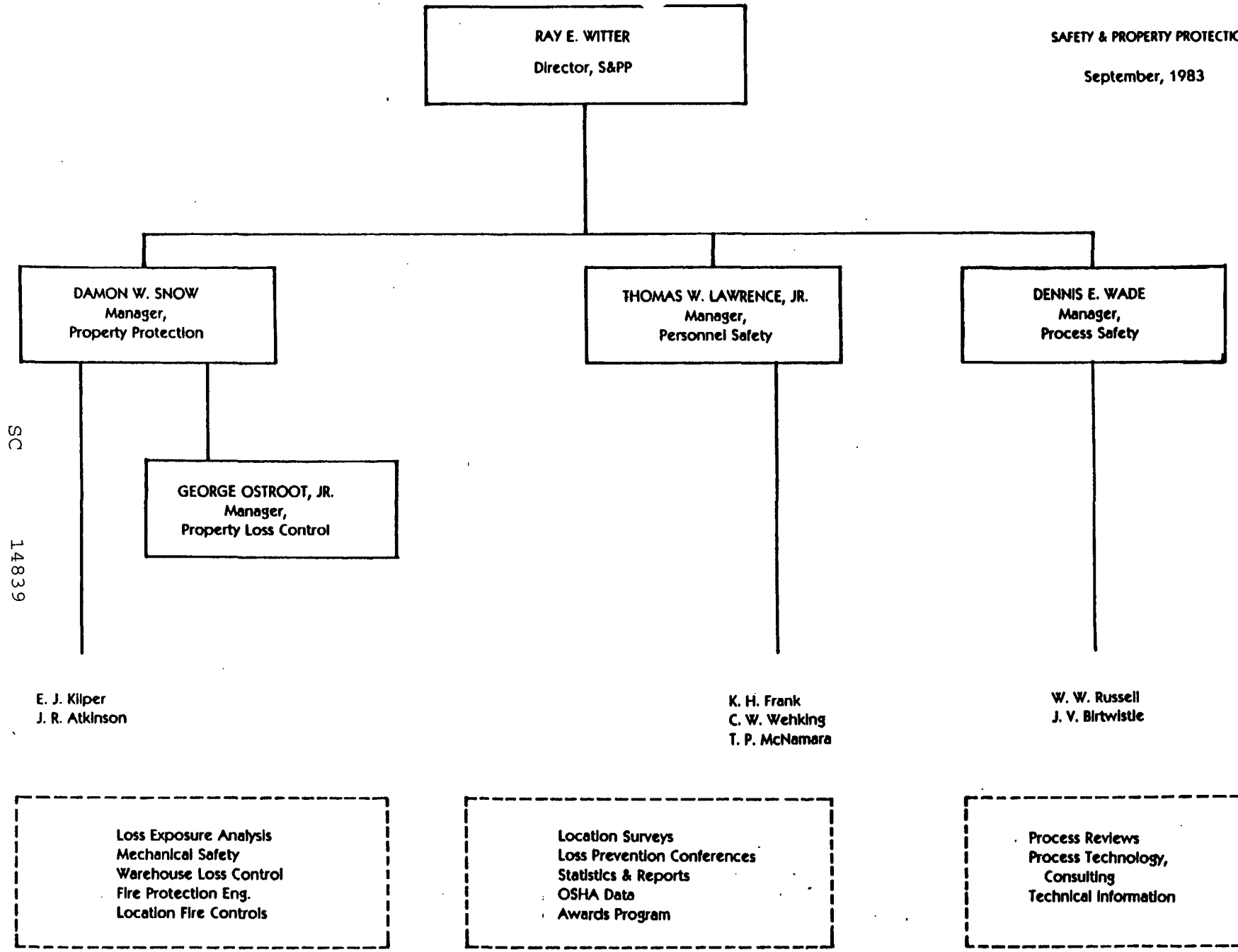

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