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To : Distribution

From : S. B. Vick

Date : February 24, 1982

Subject: EMISSIONS RECOVERY SYSTEM REVISIONS

Attached is the Class A process design to improve the operating performance of the emissions recovery system.

The revisions outlined in the process design include: (1) replacement of the existing Nash H-5 vacuum pumps, (2) replacement of the existing Nash 1253 compressors with new Nash 1253C compressors, (3) two interstage control loops, one to prevent high pressure (greater than 5 psi) and one to prevent low pressure (less than 1 psi) on the compressor suction, (4) instrumentation to start/stop the space vacuum pump/compressor train upon high system pressure, (5) a spare compressant seal water pump, (6) a spare compressant seal water filter, (7) replacement of the existing Fisher Porter compressant seal water flow controllers with Universal Flow Monitor flow switches, and (8) replacement of the mechanical seal flush system.

Please review the design and prepare any questions and comments. The review meeting for this design will be held

Bruce Vick
Process Engineer

rah

c: JF, CRM, RAF, PEM, SJV, AHS, JAD(2), VEM, VLT, JLH, RR, MPB

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EMISSIONS RECOVERY SYSTEM REVISIONS

Aberdeen Chemical Plant

February 25, 1982

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I. Purpose of Design

The overall objective of this design is to provide a system capable of maintaining negative pressure (15 IN.Hg vacuum gauge) on all VCM emission sources with minimal operator attention. The VCM emission sources included in the overall scope of the system are: (1) VCM tank farm, (2) VCM railcar unloading lines, (3) batch water strippers, and (4) vessel purge systems.

The motivation for providing a system capable of maintaining negative pressure on the areas mentioned above is: (1) to reduce operating personnel exposure to VCM, and (2) to insure EPA compliance with the VCM standard.

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II. Design Basis

The emissions recovery system is designed to recover VCM from the following areas:

(1) VCM Tank Farm
(2) VCM Railcar Unloading Areas
(3) Batch Water Strippers
(4) Vessel Purge System

System	Flowrate (SCFM) MAX
Receiver Draining (Old & New Unit)	60
VCM Unloading Lines	10
Batch Water Strippers	Nil
Tank Farm Compressors	130
TOTAL	200

The capacity required for effective operation of the system is approximately 200 SCFM.

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III. Process Description

The emissions recovery system is designed to operate continuously with little operator attention. The system pressure will be maintained at 15 IN.Hg vacuum gauge.

Two new vacuum pumps, P-301 and P-302, and two new compressors, C-301 and C-302, will be provided in the system. One vacuum pump and one compressor will operate simultaneously as a train. The vacuum pump will operate at a capacity of 185 SCFM at 15 IN.Hg vacuum and the compressor at 175 SCFM at 110 psig discharge pressure.

Two interstage control loops are provided in the system to prevent either the vacuum pumps and/or the compressors from operating beyond their respective design conditions.

The first control loop is a feedback control loop to prevent high pressure (greater than 5 psig) at the compressor(s) inlet. Pressure sensing element, PT-301, senses the pressure and transmits a signal to pressure indicating controller, PIC-301, to create a response to the high pressure at the inlet of the compressors. As the pressure increases, the response of PIC-301 is to close; therefore, restricting vapor flow and creating a false vacuum at the inlet to the vacuum pump. The reduction in the number of moles of vapor flowing from the vacuum pumps to the compressors allows the compressors to essentially "catch up"; the pressure at the inlet of the compressors will go down. PT-301 will sense the pressure reduction and allow PIC-301 to open allowing normal flow through the system.

The second control loop is also a feedback control loop. This control loop prevents low pressure (pressures equal to or less than 1 psig) at the inlet of the compressor(s). Pressure transmitter, PT-302, senses low pressure and sends a signal to pressure indicating controller, PIC-302. PIC-302 is normally closed and the response to the signal from PT-302 is to open. As PIC-302 opens, vapor flows from the discharge of the compressors to the inlet of the compressors. The vapor flow from the compressor discharge to the compressor inlet will continue until an increase in pressure is sensed by PT-302. PT-302 will transmit a signal to PIC-302 and PIC-302 will close. The increase in pressure indicates matched flow between the vacuum pumps and compressors.

III. Process Description (cont'd)

As mentioned above, one vacuum pump and one compressor will operate as a train. To insure constant vacuum in the Emissions Recovery System, instrumentation is provided to start/stop the second vacuum pump/compressor train.

Upon high pressure (5 IN Hg vacuum) in tank, T-701, high pressure switch, PSH-301, will start the vacuum pump or compressor not on stream. As the system pressure is reduced to setpoint (15 IN.Hg vacuum), low pressure switch, PSL-301, will stop the vacuum pump/compressor train brought on stream as a result of high system pressure.

Control valves are provided on the suction lines on each vacuum pump and compressor, and the compressant seal water lines. These control valves are wired into the motor run circuit of the corresponding vacuum pump or compressor. When a vacuum pump or compressor is started and brought on stream, these valves will open, and when the vacuum pump and compressor is stopped, the corresponding control valves will close.

New compressant seal water pump, NP-301, will be added to the existing closed loop compressant seal water system as a spare to the existing equipment.

NP-301 will have the capability of supplying compressant seal water to the two new vacuum pumps, P-301 and P-302, and new compressors, C-301 and C-302. NP-301 will take suction off the vacuum pump knockout pot, T-702, and discharge into line 2-HM-328. The compressant seal water will be filtered through the existing seal water filters. The filtered compressant seal water will flow from the filter to the existing compressant seal water coolers. Modifications to the inlet piping of the compressant seal water coolers is to be made to allow the coolers to be used in parallel. The modifications to be made involve the installation of two manual valves in the cooler bypass lines. (See Sketch on Figure 2). The compressant seal water flows from the coolers back to the vacuum pumps and compressors to form the liquid ring in these machines.

The existing Fisher Porter compressant flow controllers will be replaced with Universal Flow Monitor flow switches. A globe valve will be installed upstream of the flow switch and set to provide the required flow to the vacuum pump or compressor. If the flow falls below the required compressant seal water flow, an alarm will sound notifying the operator attention is required to correct the flow.

The existing mechanical seal flush system will be replaced with a new mechanical seal flush system. The new system will be piped with stainless steel from the HPSW filter up to the mechanical seal flush inlet port on the vacuum pumps and compressors. The rotameters to be installed in this service are to be insulated and steam traced to provide adequate freeze protection. This will keep the rotameters from bursting and allow a continuous flow of seal water to the double mechanical seals on P-301, P-302, C-301, & C-302 during cold temperature conditions.

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IV. Equipment Specifications

Item No.	Service	Location
C-301	Compressor	Emissions Recovery Sys.
C-302	Compressor	Emissions Recovery Sys.
NP-301	Compressant Seal H_2O Pump	2-HM-327
P-301	Vacuum Pump	3-HM-301
P-302	Vacuum Pump	3-HM-303

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V. Instrument Specifications

Item No.	Service	Location
CV-301	On/Off Control Valve	3-HM-301
CV-302	On/Off Control Valve	3-HM-303
CV-303	On/Off Control Valve	C-301 Inlet
CV-304	On/Off Control Valve	C-302 Inlet
CV-305	On/Off Control Valve	P-301 Seal H_2O Line
CV-306	On/Off Control Valve	P-302 Seal H_2O Line
CV-307	On/Off Control Valve	C-301 Seal H_2O Line
CV-308	On/Off Control Valve	C-302 Seal H_2O Line
CV-309	On/Off Control Valve	2-HM-332
CV-310	On/Off Control Valve	2-HM-333
FA-301	Flow Alarm	Vinyl Control Room
FA-302	Flow Alarm	Vinyl Control Room
FA-303	Flow Alarm	Vinyl Control Room
FA-304	Flow Alarm	Vinyl Control Room
FI-301	Flow Indicator	½-WP-310
FI-302	Flow Indicator	½-WP-314
FI-303	Flow Indicator	½-WP-315
FI-304	Flow Indicator	½-WP-311
FI-305	Flow Indicator	½-WP-316
FI-306	Flow Indicator	½-WP-312
FI-307	Flow Indicator	½-WP-317
FI-308	Flow Indicator	½-WP-313
FS-301	Flow Switch	P-301 Seal H_2O Line
FS-302	Flow Switch	P-302 Seal H_2O Line
FS-303	Flow Switch	C-301 Seal H_2O Line
FS-304	Flow Switch	C-302 Seal H_2O Line
PCL-301	Pressure Regulator	½-WP-310
PCL-302	Pressure Regulator	½-WP-311
PCL-303	Pressure Regulator	½-WP-312
PCL-304	Pressure Regulator	½-WP-313
PIC-301	Pressure Controller	Vacuum Pump Suction
PIC-302	Pressure Controller	Compressor Discharge

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V. Instrumentation Specifications (cont'd)

Item No.	Service	Location
PG-301	Pressure Gauge	P-301 Seal H_2O Line
PG-302	Pressure Gauge	P-302 Seal H_2O Line
PG-303	Pressure Gauge	C-301 Seal H_2O Line
PG-304	Pressure Gauge	C-302 Seal H_2O Line
PG-305	Pressure Gauge	½-WP-310
PG-306	Pressure Gauge	½-WP-311
PG-307	Pressure Gauge	½-WP-312
PG-308	Pressure Gauge	½-WP-313
PG-309	Pressure Gauge	3-HM-301
PG-310	Pressure Gauge	3-HM-302
PG-311	Pressure Gauge	3-HM-303
PG-312	Pressure Gauge	3-HM-304
PG-313	Pressure Gauge	C-301 Suction
PG-314	Pressure Gauge	C-301 Discharge
PG-315	Pressure Gauge	C-302 Suction
PG-316	Pressure Gauge	C-302 Discharge
PG-317	Pressure Gauge	½-WP-318
PG-318	Pressure Gauge	½-WP-319
PG-319	Pressure Gauge	½-WP-320
PG-320	Pressure Gauge	½-WP-321
PG-321	Pressure Gauge	½-WP-322
PG-322	Pressure Gauge	½-WP-323
PG-323	Pressure Gauge	½-WP-324
PG-324	Pressure Gauge	½-WP-325
PG-325	Pressure Gauge	3/4-WP-306
PG-326	Pressure Gauge	3/4-WP-306
PG-327	Pressure Gauge	3/4-WP-307
PG-328	Pressure Gauge	3/4-WP-309
PG-329	Pressure Gauge	Existing Seal H_2O Pump
PG-330	Pressure Gauge	Existing Seal H_2O Pump
PG-331	Pressure Gauge	2-HM-328
PSH-301	High Pressure Switch	T-701
PSL-301	Low Pressure Switch	T-701
PR-301	Pressure Recorder	Emissions Recovery Sys.
RO-301	Restriction Orifice	2-HM-332
RO-302	Restriction Orifice	2-HM-333

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V. Instrumentation Specifications (cont'd)

Item No.	Service	Location
SW-301	Hand/Off/Auto Switch	P-301
SW-302	Hand/Off/Auto Switch	P-302
SW-303	Hand/Off/Auto Switch	C-301
SW-304	Hand/Off/Auto Switch	C-302
SW-305	On/Off Switch	Existing Seal H_2O Pump
SW-307	On/Off Switch	NP-301

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VI. Process Piping Schedule

The following piping schedule uses a system of numbers and letters as a line designation. This system denotes the following information: line size, service, line number, insulation requirements, and piping specifications.

Sample Line Designation

1-HM-326-N-A2-3

	Piping Specification
	Insulation Requirement
	Line Number
	Service
	Normal Size, Inches

Sample Piping Specification

A2-3

	Third Specification of A2 Group
	Piping Material
	Nominal Pressure Rating

Service Designation Used

Designation	Service
HM	Miscellaneous Hydrocarbons
WP	High Pressure Service Water

Insulation

N	No Insulation Required
S	Steam Trace

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VII. Work List

1. Purchase and install new vacuum pumps, P-301 and P-302.

2. Purchase and install new compressors, C-301 and C-302.

3. Tie lines 3-HM-301 and 3-HM-303 into the existing vacuum pump inlet piping.

4. Run line 3-HM-302 from P-301 discharge to the existing inlet flange on the vacuum pump seal water separator.

5. Tie line 3-HM-304 into line 3-HM-302.

6. Purchase and install new pump, NP-301.

7. Tie line 2-HM-327 into the existing suction piping of the existing seal water pumps off T-702.

8. Tie line 2-HM-329 into the existing discharge piping of the existing seal water pumps.

9. Modify inlet piping to existing seal water coolers. (See figure 2)

10. Replace the existing compressant seal water flow controller with the Universal Flow switch.

11. Install CV-303 and CV-304 in the existing piping to the new compressors, C-301 and C-302.

12. Install CV-305, CV-306, CV-307, and CV-308 in the compressant seal water lines to the new vacuum pumps and compressors.

13. Install 2-HM-305 from the compressor discharge manifold to the compressor inlet manifold.

14. Install PIC-302 in line 2-HM-305.

15. Install PIC-301 in the existing inlet line to the suction of the vacuum pumps.

16. Install PSH-301 and PSL-301 on existing knockout tank, T-701.

17. Install the new stainless steel mechanical flush system with instrumentation.

18. Check all piping downstream of the compressors in VCM service for pluggage (VCM polymerization, pipe scale, etc.). Any obstruction found in the line is to be cleaned and removed from the line.