INDUSTRIAL VACUUM LIQUID & WASTE WATER CONVEYANCE SYSTEMS IN CLEANROOM SYRINGE WASHING OPERATIONS & OTHER APPLICATIONS

Phil Crincoli
ISPE Product Show
Track 1, Session 1
September 26, 2018

Phil Crincoli
Speaker Bio

> Environmental Business for 20 years
> 2 Tours of Duty with WM National Sales
> Integrated Facility Management for 10 years
> Former VP of IFMA-NJ
> Member of ISPE since 2001. NJ/DVC Sponsors
> Chemistry Council of NJ Committees
> US Green Building Council – NJ
> 40 Hour HAZWOPER in 1993
> LEAN Certification in 2015
> Joined Airvac in 2017 as Ind. Segment and Maritime Sales Manager
HOW IT WORKS

Vacuum Liquid Conveyance Systems
Industrial Applications

> FDA Regulated and Food Processing Facilities
> Manufacturing Sites (Steel, power & Chemical Plants)
> Leachate Control Systems at Landfills
> Brownfield Site Construction
> Green and LEED Projects (Solvis & Calamigos)
> Stadiums, exhibition halls & Arenas
> Transportation: Trains, Planes, Cruise Ships
Vacuum Liquid Conveyance Systems
How It Works

> Liquid flows from facility sources to various evacuation units

> Normally closed pneumatic interface valve opens & constant vacuum within the piping pulls liquid into the pipe

> Vacuum station applies negative pressure to the small diameter piping network & centrally collects the liquid

> Multiple waste streams can be collected & discharged separately

> Basic principles + proven reliability = effective solutions
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Vacuum Liquid Conveyance Systems
Key System Advantages

> Vertically lift liquid 20’+ without electricity at the source
> Eliminate blockages due to high scouring velocities
> No infiltration or exfiltration into/from piping
> Construction duration up to 60% shorter & installation COST less than gravity as piping can be installed in walls & ceiling
> Separation of Contaminated Liquids
> Maintenance outside Controlled Environments
> Indoor, Outdoor and Integrated Systems
Vacuum Liquid Conveyance Systems
Sample Layout Design

Vacuum Liquid Conveyance Systems
Outdoor Systems
PROBLEM SOLVING

Case Study
Merck (Cleanroom) – Validated Environment

Background
> One of the largest vaccine manufacturing sites in world
> Location undergoes frequent renovation
> Syringe Washing operation in Cleanroom (Gardasil, Hep C)
> Needed wastewater conveyance system to separate streams

Situation
> Cleanroom in tight space would not allow gravity system
> Access to area limited & many obstacles in place
> Zero tolerance system leaks & no room for dual containment
Case Study
Merck (Cleanroom) – Validated Environment

Solution
> Piping & system controllers placed in walls/ceilings/attics
> Separation of chemical & biological streams in 3 vats
> Single vacuum source maintains negative pressure - no leaks

Case Study
Roche-Basel, Switzerland (Labs & R&D)

Background
> New 10 floor facility w/ modular design for frequent changes
> Over 70 small labs & 4 large full floor labs, office, R&D
> High visibility state-of-a rt campus in downtown Basel

Situation
> Areas can be changed from office to lab to R&D
> All furniture, basins are movable
> Moves allow for easy hook ups and change outs
> S3 Level (BSL 4) in certain areas includes air burned
Case Study
Roche-Basel, Switzerland (Labs & R&D)

Solution
> 270 vacuum floor drains installed allow optional usage
> 12 autoclaves in basement also on vacuum
> 2 vacuum stations supply negative pressure for building

Case Study
Leidos Corporation-Boyers, PA (R&D Lab)

Background
> Facility is located 220 feet underground
> Leidos needed a highly secure R&D facility for experiments
> Former division of SAIC Corporation
> Location is part of Iron Mountain high security facility

Situation
> Due to facility depth, no gravity option on wastewater
> Minimization of wastewater discharge due to cost
> Sustainable solution that recycles almost all water on site
Case Study
Leidos Corporation-Boyers, PA (R&D Lab)

Solution
> The vacuum system hooked to bioreactor treatment
> All lab & gray water, & most of black water recycled on site
> Small filter sludge disposed offsite

Case Study
Eli Lilly-Eco Services (Solvay)-Kimberly Clark (underground)

Background
> Major firms in pharmaceuticals, chemicals & manufacturing
> Locations in Indiana, Louisiana and Alabama
> Systems boast longevity and reliability

Situation
> Excavation of these older sites was not safe or practical
> Site challenges included high water table, underground hazards: unknown utilities, buried chemicals and areas of high truck traffic subject to frequent ground shifting
Case Study
Eli Lilly-Eco Services (Solvay)-Kimberly Clark (underground)

Solution
> Vacuum sewage systems tie in multiple buildings
> The system conveys all wastewaters (Black & Gray)
> Our systems have been operational since the 1970s

Case Study
Calamigos Ranch, Malibu, CA (Net Zero Project)

Background
> 200 acre privately owned Ranch that serves as Corporate Conference Center, Movie Set and Amusement Park.
> Rapidly deteriorating ecological problems include decreasing fresh water table with groundwater pollution seeping into ocean, creating unsafe & unhealthy conditions along coast.

Situation
> Sources of fresh water decreasing and pollution increasing
> Calamigos wanted a practical, yet fully sustainable solution with a Net Zero goal
Case Study
Calamigos Ranch, Malibu, CA (Net Zero Project)

Solution
> The vacuum system pilot will modernize & centralize sewer system
> Hydrogen House will provide on site Bio treatment of Black water with recycled sludge, Gray water will be reused and energy supplied will be via fuel cells and solar energy

Case Study
Pratt & Whitney (Stantec), Montreal, Canada

Background
Pratt & Whitney operates a catastrophic test burn facility in Montreal Canada for determining integrity duration of jet engines, should they catch on fire during flight operations. Once test burning is complete, the jet engines are extinguished with combination of fire retardants and water.

Situation
Stantec was selected for construction of wastewater collection area to protect sensitive environmental areas, that will segregate the liquids contaminated with jet fuel, water and fire retardants, which could exceed 26K gallons over 5-10 minutes.
Case Study
Pratt & Whitney (Stantec), Montreal, Canada

Solution
The vacuum system replaces the existing gravity system. The vacuum wastewater system will be able to safely segregate contaminated fluids and send them for specialized pre-treatment, protecting area aquifers in a closed system.

Case Study
Additional Case Studies

> Bayer Pharmaceutical—Design for Cleanroom vacuum wastewater conveyance system in Berlin

> Beta Gama Services– LLRW contaminated liquids for a food irradiation plant in Germany

> NECCO Revere, MA – Floor wand, drain and vacuum system customized by Airvac in candy factory
Vacuum Liquid Conveyance Systems

Vacuum vs. Gravity - Material vs. Labor Cost

*Vacuum station includes an additional 10% in pump redundancy*
Vacuum Liquid Conveyance Systems
Sample Product and Componentry Details: Vacuum Station

Vacuum Pumps
> Maintains constant vacuum range (16-20" Hg) on tank & piping

Collection Tank
> Centrally collects liquid
> Multiple liquid streams can be collected via one vacuum station

Discharge Pumps
> Discharges collected liquid for reuse, pretreatment &/or treatment

Misc.
> All pumps alternate lead/lag & redundancy
> Fabricated & pretested at factory & commissioned onsite

AE25
> 20' lift max
> 1 ½" pipe connection
> Liquid only
> Mounts under sink
> .06 gal / cycle
> 2 GPM
Vacuum Liquid Conveyance Systems
Sample Product and Componentry Details: Liquid Collection

GK Unit

> 20' lift max
> 1" pipe connection
> Liquid only
> Stainless steel
> .26 gal /cycle
> 8 GPM

Floor Drain

> 20' lift max
> 1" pipe connect
> Liquid only
> Stainless steel
> .27 gal /cycle
> 8 GPM
Vacuum Liquid Conveyance Systems
Sample Product and Componentry Details: Liquid/Solid Collection

Vacuum Toilets

> 1 ½" connection
> 78 dB
> Vertically lift 20’+
> Floor mount
> Wall mount
> Stainless steel

Collection Sumps

> Sizes ¾ to 50 gallons
> Liquid & solids
> Vertically lift up to 20’
> PE, FG & SS
> Pneumatic/no power requirements
# Vacuum Liquid Conveyance Systems

**Questionnaire**

<table>
<thead>
<tr>
<th>WHAT IS NEEDED</th>
<th>DESCRIPTION</th>
<th>WHY NEEDED?</th>
<th>INFORMATION PROVIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map clearly showing the area to be served</td>
<td>This can be as detailed as an ACAD drawing or as simple as a scan of a map with the service area outlined with a sharpie</td>
<td>There are physical limitations to a vacuum system in terms of elevation differences, how far the system can be extended and how much flow can be handled by a single vacuum station</td>
<td>Describe type of mapping provided</td>
</tr>
<tr>
<td># of connections to be served</td>
<td>Please provide the total # of connections to be served. Ideally, this should match the # shown on the map provided</td>
<td>In addition to vacuum main &amp; vacuum station component sizing, this information is needed to determine how many and what type of collection chambers are needed</td>
<td>Provide the total # connections</td>
</tr>
<tr>
<td>Flow rate</td>
<td>Please provide the average and peak flow rates expected at each connection</td>
<td>Vacuum main &amp; vacuum station component sizing as well as the type of collection chambers are a function of flow rate</td>
<td>Provide the connection #餲 (and connections)</td>
</tr>
</tbody>
</table>
| Lifting requirements | Please provide the required vertical lifting requirements | The flexibility of the vacuum system allows liquid to be vertically lifted 20% and the vacuum main, pumps & collection chambers need to be sized per the requirements | List vertical lifting requirements (Typ, #20%)
| Expanse | Let us know if additional capacity for future growth or project phasing needs to be considered | Depending on the magnitude, this could affect the vacuum main and vacuum station size and how we approach the layout itself | Describe expansion possibilities or phasing plans |
| Liquid type & temperature | Please provide the type and average temperature of the liquid to be collected | Depending on the liquid type and temperature, this could impact the type of equipment we propose | List type of chemical & its temperature |
| Possible inlet for a vacuum blower | Please indicate a location that may be a candidate for a vacuum station. A centrally located area is ideal. | The # of vacuum mains required as well as their size is dependent on where the station is located | Indicate possible inlet location or show on map |

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