Lockheed Martin Corporation
6801 Rockledge Drive MP: CCT-246
Bethesda, MD 20817
Telephone 301-548-2209

October 12, 2021

VIA EMAIL AND PRIVATE CARRIER

Gary Schold, Project Manager
Land Restoration Program
Land and Materials Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230

Subject: 100% Design Sub-Slab Depressurization Systems-
Drop Hammer Building, Building A, Building C
Lockheed Martin Corporation – Middle River Complex
2323 Eastern Boulevard, Middle River, Baltimore County, Maryland

Dear Mr. Schold,
For your information, please find enclosed two hard copies with a CD of the above-referenced documents. These documents were prepared to describe the proposed installation of sub-slab depressurization systems in the Drop Hammer Building, Building A and Building C of the Middle River Complex in Middle River, Maryland.

Please let me know if you have any questions. My office phone is (301) 548-2209.

Sincerely,

Thomas D. Blackman
Project Lead, Environmental Remediation

cc: (via email without enclosure)

Anuradha Mohanty, MDE
Mark Mank, MDE
Christine Kline, Lockheed Martin
Mary Morningstar, Lockheed Martin
Tom Green, LMCPI
James Damm, LMCPI
Michael Martin, Tetra Tech
Cannon Silver, CDM Smith

cc: (via Box)
Jann Richardson, Lockheed Martin
Scott Heinlein, LMCPI
Christopher Keller, LMCPI
Glen Harriel, LMCPI
Rina Scales, LMCPI

cc: (via mail with enclosure)
Budd Zahn, MRAS

100% DESIGN
SUB-SLAB DEPRESSURIZATION SYSTEM
FOURTH-PHASE EXPANSION – BUILDING A
LOCKHEED MARTIN MIDDLE RIVER COMPLEX
2323 EASTERN BOULEVARD
MIDDLE RIVER, MARYLAND

Prepared for:
Lockheed Martin Corporation

Prepared by:
Tetra Tech, Inc.

October 2021

Revision: 0

Michael Martin, P.G.
Regional Manager

Peter A. Rich, P.E.
Principal Engineer

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

ACRONYMS

µg/m3	micrograms per cubic meter
%	percent
cis-1,2-DCE	cis-1,2-dichloroethene
CQCP	construction quality control plan
COMAR	Code of Maryland Regulations
ºF	degrees Fahrenheit
FMEA	failure mode and effects analysis
GAC	granular-activated carbon
HASP	health and safety plan
HVAC	heating, ventilation, and air conditioning
IA	indoor air
lbs/day	pounds per day
Lockheed Martin	Lockheed Martin Corporation
MDE	Maryland Department of the Environment
OM&M	operation, maintenance, and monitoring
PVC	polyvinyl chloride
RTO	remedial technical operations
SCFM	standard cubic feet per minute
SSD	sub-slab depressurization
TCE	trichloroethene
Tetra Tech	Tetra Tech, Inc.
TO-15	Toxic Organic Method-15
USEPA	United States Environmental Protection Agency
VMP	vapor monitoring point
VOC	volatile organic compound
WC	water column
WMP	waste management plan

SECTION 1
INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has prepared this 100% design on behalf of Lockheed Martin Corporation (Lockheed Martin) to describe the proposed fourth-phase expansion of the sub-slab depressurization (SSD) system currently operating in Building A at the Middle River Complex in Middle River, Maryland; see location on Drawing G1 in Appendix A. The expansion will consist of installing a vacuum seal, a hose connection, and piping at basement sumps SP-1 and SP-1A to connect them to the sub-slab depressurization system for continuous vapor extraction.

The system has been operating since its installation in March 2008; it applies vacuum under the concrete floor in areas where elevated volatile organic compounds (VOCs) are found in the soil gas. The sub-slab vacuum draws volatile organic compounds from extraction points and maintains a negative pressure below the slab (relative to the room space), thus minimizing the migration of chemicals from sub-slab soil into indoor air (IA).

The system originally included two horizontal vapor extraction trenches (the "north" and "south" extraction laterals) in the former plating shop (i.e., the current "lay-up" room in the western side of the building). The system location is shown on Drawings G1 and G2 in Appendix A. Vapor monitoring points (VMPs) were installed, as were a regenerative blower, a moisture separator, two 200-pound granular-activated carbon (GAC) drums, and an exhaust stack that extends above the roof of the building. The system's "blowers skid" (blower, moisture separator, control panel, filters, and appurtenances), granular-activated carbon drums, and exhaust stack are on the loading dock just outside the lay-up room.

A first-phase system expansion completed in October 2010 addressed elevated sub-slab volatile organic compounds detected in the middle area of the Building A basement. During the first-phase expansion, two horizontal vapor extraction trenches (i.e., the "basement-north" and "basement-south" extraction laterals) were also installed, and the 200-pound granular-activated carbon drums were replaced with 400-pound drums. In addition, three stand-alone indoor-air filters (IQAir GC™

Series-GC VOC) were installed in January 2015 near vapor monitoring points 093-A and 138-A, and indoor air monitoring location 093-A-X in the Building A basement (south of the vapor extraction trenches; refer to Drawing G2). The filters are continuously operated to address trichloroethene (TCE) concentrations possibly above its screening level in indoor air.

A second-phase system expansion completed in April 2016 included replacement of the original blower skid, and installation of five new extraction and vapor monitoring points to address areas along the eastern side of Building A (near VMPs 136-A, 079-A, and 117-A), where elevated concentrations of volatile organic compounds were detected in the sub-slab in 2014-2015. More recently, a parallel train of two, 400-pound carbon units in series was added to the system in February 2017 to improve treatment efficiency, to increase system flow capacity, and to reduce blower outlet pressure.

A third-phase system expansion completed in July 2017 included the addition of one vertical extraction point and one vapor monitoring point, installing a second moisture separator, improving the granular-activated carbon pipe and hose connections, extending the sub-slab depressurization system header to the southern area of the Building A basement, and installing a vacuum seal and hose connection in basement sump HRS-5 to extract vapor from the sump. Vapor extraction from sump HRS-5 ceased in 2019 when the sump was permanently abandoned by filling it with concrete.

The proposed fourth-phase expansion will consist of installing a vacuum seal, a hose connection, and piping at adjacent basement sumps SP-1 and SP-1A to connect them to the sub-slab depressurization system header in the Building A basement.

This design document is organized as follows:

Section 1—Introduction: Briefly describes the history of the existing sub-slab-depressurization system in Building A.

Section 2—Basis of Design: Presents the technical basis for the expansion design.

Section 3—100 Percent Design: Describes the components of the system expansion.

Section 4—Performance Monitoring: Describes the planned system startup, operation, monitoring, and proposed project schedule.

Section 5—References: Lists the references used in this design document.

SECTION 2
BASIS OF DESIGN

The primary design objective for the fourth-phase expansion of the sub-slab depressurization (SSD) system is to mitigate potential vapor migration of volatile organic compounds (VOCs) from sumps SP-1 and SP-1A in the Building A basement by covering the sumps with an airtight seal, enabling the withdrawal of vapor from the sumps. To achieve the system expansion objective, both sumps will be sealed, and a hose will be installed to connect the sumps to the SSD system for continuous vapor extraction.

The proposed system expansion is based on the detection of elevated VOC concentrations in the water of these sumps during sampling in March 2018. At that time, trichloroethene (TCE) was detected in indoor air (IA) of the basement at a concentration of 160 micrograms per cubic meter ($\mu g/m^3$), and elevated concentrations of VOCs had been detected during IA sampling for the past several years.

SP-1 and SP-1A are adjacent sumps in the Building A basement connected underground with a six-inch-diameter pipe. The sumps have a circular frame and covered openings; SP-1 is 24-inches in diameter and SP-1A is 18-inches in diameter. In May 2019, sump SP-1 was pumped out and inspected; the following observations were noted:

- The sump has a gravel bottom, indicating that it acts as a French drain and draws in groundwater; recharge was observed to be relatively slow.
- The sump depth, from the basement floor surface to the bottom of sump, is 82 inches.
- The connection between SP-1 to SP-1A is a six-inch-diameter pipe and is visible from SP-1.
- No other pipe connections to SP-1 (besides the connection to SP-1A) were visible.
- SP-1 has an active sump pump, and its piping connects to a header line toward lift station #5. SP-1A does not have its own (separate) pump.

SECTION 3
100-PERCENT DESIGN

The fourth-phase expansion for the sub-slab depressurization (SSD) system includes the following:

- Installing an air-tight seal on sumps SP-1 and SP-1A in the Building A basement.
- Installing two-inch-diameter Schedule 40 polyvinyl chloride (PVC) piping and a flexible hose connection from the SP-1/SP-1A sumps to the SSD system for continuous vapor extraction, using the existing four-inch-diameter Schedule 40 PVC pipe that was previously installed for vapor extraction at former sump HR-5.
- Installing valves and vapor measuring points on these connections to control and measure the vapor extraction rate and applied vacuum at the sumps.
- Maintaining the operation of SP-1 as an active pumping sump, allowing for maintenance of the pump, pipe, and electrical connections, if needed.

Drawings showing the items listed above are in Appendix A. The design of each expansion component is discussed below.

3.1 VACUUM SEAL AND PIPING CONNECTION

In preparation for the vacuum seal installation, the concrete around basement sumps SP-1 and SP-1A, will be cleaned with water and Simple Green. The sumps will then be sealed with plywood overlain by 40-mil polyethylene sheeting, StegoTack® double-sided tape, pea gravel, and Great Stuff™ foam sealer. Subsequently, a two-inch bulkhead and two-inch-diameter hose fittings will be installed into each seal (see Drawing G2 in Appendix A). The equipment and material list is in Appendix B.

Approximately 10 feet of two-inch-diameter, clear flexible hose (each) will be used to connect the hose fittings installed into the sump seals to the Building A SSD system header pipe currently present above the SP-1 and SP-1A sumps. Ball valves will be installed at the connection to the SSD system header pipe; these valves will be used as throttling and measuring points for air-flow rate and vacuum, and will also be used for SSD system testing and operation. Vapor present above sump

water will be routed into the common header to the blower skid, where it will be joined with vapor from the other system soil vapor extraction points.

3.2 ESTIMATED MASS EXTRACTION AND PERMITS

The Building A SSD system currently removes approximately 0.04 pounds of volatile organic compounds (VOCs) per day and operates at a total extraction rate of approximately 350 standard cubic feet per minute (SCFM) using four horizontally screened extraction trenches and six vertically screened extraction points. The addition of extraction at sumps SP-1 and SP-1A is expected to add approximately 25 SCFM of combined flow, based on experience with extraction at former basement sump HRS-5. The additional mass removal will be minimal (initially 0.05 pounds per day at most, and much less thereafter) and difficult to determine with the existing operating system flows, based on previous experience with vapor extraction at sump HRS-5.

Tetra Tech will continue to collect process vapor samples based on the requirements (currently, once every two months) in the approved system operation, maintenance, and monitoring (OM&M) manual (Tetra Tech, 2021a).

Even without granular activated carbon (GAC) treatment, the current mass extraction rate (approximately 10 pounds of VOCs per year) is below the Title 5 emission level (25 tons VOCs per year) regulated by Maryland Department of the Environment (MDE) and found in Code of Maryland Regulations (COMAR) 26.11.02.01C. In addition, extraction rates less than one pound per day qualify for the *de minimus* exemption under COMAR 26.11.02.10X. Therefore, no air permit is required for the Building A SSD system, even with this expansion; this was previously confirmed with MDE during SSD system installation and previous Building A expansions. We will provide the Middle River Complex facility with total annual emission volumes for their reporting requirements. Based on discussions with the facility during previous SSD system installations, no building or other permits will be required for the proposed construction associated with system expansion.

Table 1

Estimated Mass Extraction Rates
Building A SSD System Fourth-Phase Expansion
Lockheed Martin Middle River Complex, Middle River, Maryland

Vapor extraction point	Estimated average flow (SCFM)	Estimated VOC concentration (µg/m^3)	Estimated initial^ mass extraction (lbs/day)
Existing horizontal basement trenches and vertical extraction points on main floor	350	1,100[a]	0.035
New SP-1/SP-1A sump extraction point	25	20,000 estimate	0.045

^VOC concentrations at SP-1/SP1-A are expected to decrease up to 90% during the first month of operation
lbs/day – pounds per day µg/m^3 – micrograms per cubic meter SCFM – standard cubic feet per minute
SSD – sub-slab depressurization VOC – volatile organic compounds
Mass extraction (lbs/day) = µg/L × L/min x 1,440 min/day x 1 lb/4.54 x 10^{-6} µg
[a] Based on total VOC influent SSD system concentrations in March 2021

3.3 FAILURE-MODE AND EFFECTS ANALYSIS

Tetra Tech, Lockheed Martin, and its remedial technical operations (RTO) contractor conducted a failure mode and effects analysis (FMEA) on August 26, 2021 via a virtual (online) meeting. The purpose of the FMEA is to examine work for single or multiple point failures that could cause a release of untreated soil vapors to the environment or cause damage to the SSD system. The results of the FMEA have been incorporated into the design document. FMEA documentation is in Appendix C.

3.4 WORK PLANS AND PROPOSED CONSTRUCTION SCHEDULE

The construction work plans for the fourth-phase expansion, prepared by Tetra Tech (available under separate cover), will be followed. Those plans include a construction quality control plan (CQCP) (Tetra Tech, 2021b), a site and temporary facilities plan (Tetra Tech, 2021c), and a project-specific health and safety plan (HASP) (Tetra Tech, 2021d). The HASP includes an emergency response plan. The facility's current investigation-derived waste management plan (CDM Smith, 2021) will be used to manage wastes generated during the construction of the SSD system expansion.

The CQCP presents the approach for confirming that the system is installed consistent with the design intent. The site and temporary facilities plan details the temporary facilities required to advance work and the best management practices that will be used to limit impact to Building A tenants and operations. The HASP includes procedures used to protect workers and the public from

potential hazards during construction and operation and maintenance of the SSD system. The emergency response plan, included in the HASP, outlines emergency procedures.

The system's OM&M manual (Tetra Tech, 2021a) will be updated to include the new SP-1/SP-1A extraction points. The construction of the fourth-phase system expansion is expected to last less than one week.

SECTION 4
PERFORMANCE MONITORING

4.1 SYSTEM STARTUP AND OPERATION

After the fourth-phase system expansion is installed, extraction from SP-1 and SP-1A will be adjusted by taking vacuum and flow rate measurements and adjusting the diaphragm throttling valves to apply an approximately one-inch water-column vacuum at the sumps, resulting in an extraction of approximately 25 standard cubic feet per minute SCFM (total).

System checks will continue to occur every two weeks and will include measurement and adjustment (as necessary) of applied vacuum and flow rate at SP-1 and SP-1A.

4.2 SYSTEM MONITORING

System checks at SP-1 and SP-1A will include:

- Checking the sump cover seals, hose, and connecting pipe for any damage and repair as needed.
- Measuring and recording the vacuum and air velocity using a manometer and velocity meter, respectively, and adjusting as needed.

The Building A sub-slab depressurization system checklist has been updated to include monitoring at the SP-1 and SP-1A sumps; a copy of the updated system checklist, and a pre-startup checklist are in Appendix D.

SECTION 5
REFERENCES

CDM Smith, 2021. Draft. *Investigation-Derived Waste Management Plan, Lockheed Martin Middle River Complex, 2323 Eastern Boulevard Middle River, Maryland*. February.

Maryland Department of the Environment (MDE), 2007. Telephone communication between Mr. Dave Mummert (MDE Air Quality Permits Section) and Ms. B. Chang Lee (Tetra Tech) regarding anticipated volume of emissions at site not requiring an air permit. November 16.

Maryland Department of the Environment (MDE), 2015. Email communication between Mr. Nolan Penney (MDE Air Quality Permits Section) and Ms. B. Chang Lee (Tetra Tech) regarding permit exemption based on anticipated mass extraction rates. September 22, 2015.

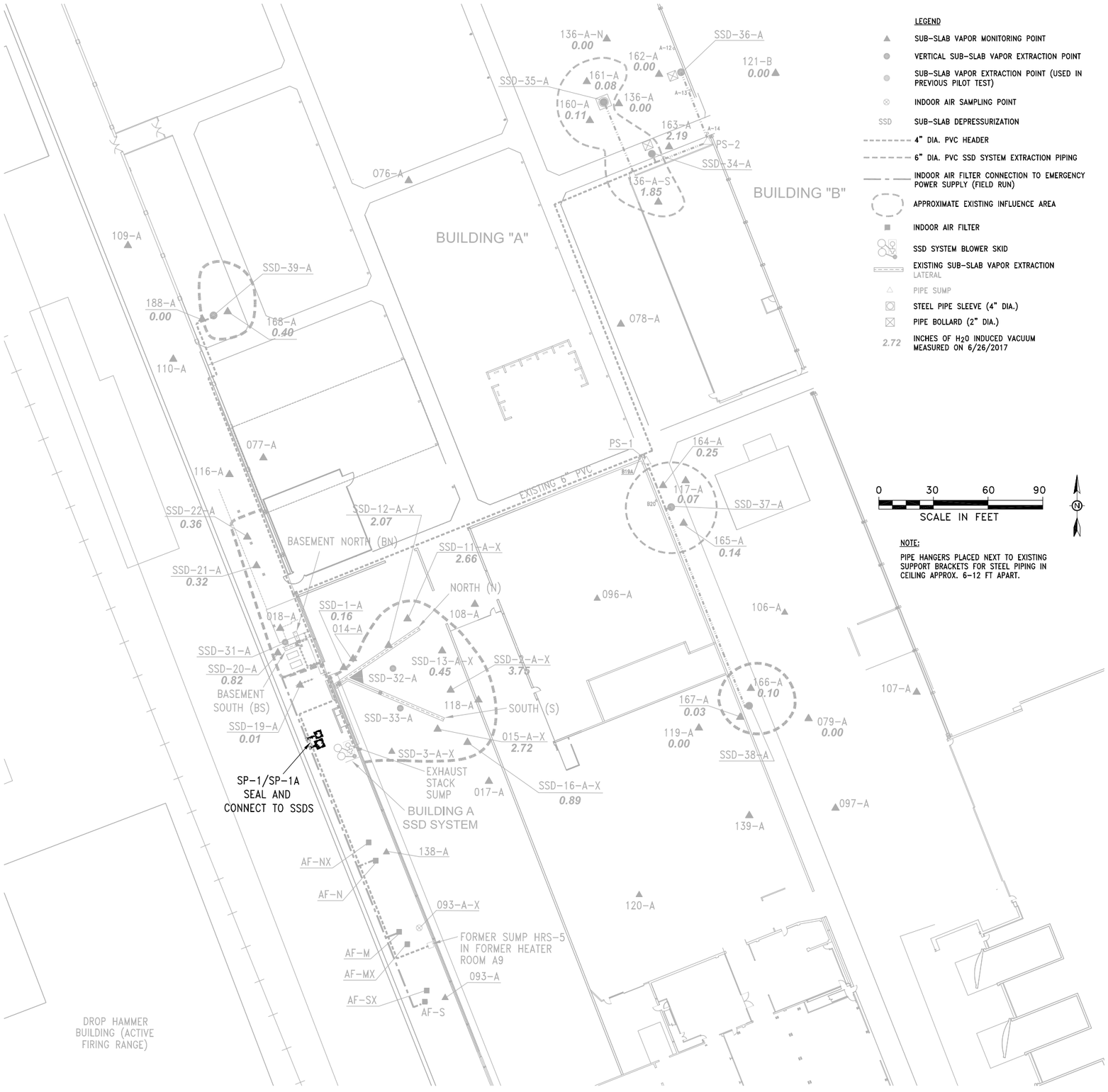
Tetra Tech, Inc. (Tetra Tech), 2021a. *Draft. Operation, Maintenance, and Monitoring Manual – Building A, Lockheed Martin Middle River Complex, 2323 Eastern Boulevard Middle River, Maryland*. April.

Tetra Tech, Inc. (Tetra Tech), 2021b. *Construction Quality Control Plan, Sub-Slab Depressurization System Fourth-Phase Expansion-Building A, Lockheed Martin Middle River Complex, 2323 Eastern Boulevard Middle River, Maryland*. September.

Tetra Tech, Inc. (Tetra Tech), 2021c. *Site and Temporary Facilities Plan, Sub-Slab Depressurization System Fourth-Phase Expansion-Building A, Lockheed Martin Middle River Complex, 2323 Eastern Boulevard Middle River, Maryland*. September.

Tetra Tech, Inc. (Tetra Tech), 2021d. *Site-Specific Health and Safety Plan for Construction, Expansion, Operation, Maintenance, and Monitoring, Sub-Slab Depressurization Systems, Lockheed Martin Middle River Complex, 2323 Eastern Boulevard Middle River, Maryland*. September.

APPENDIX A—DESIGN DRAWINGS



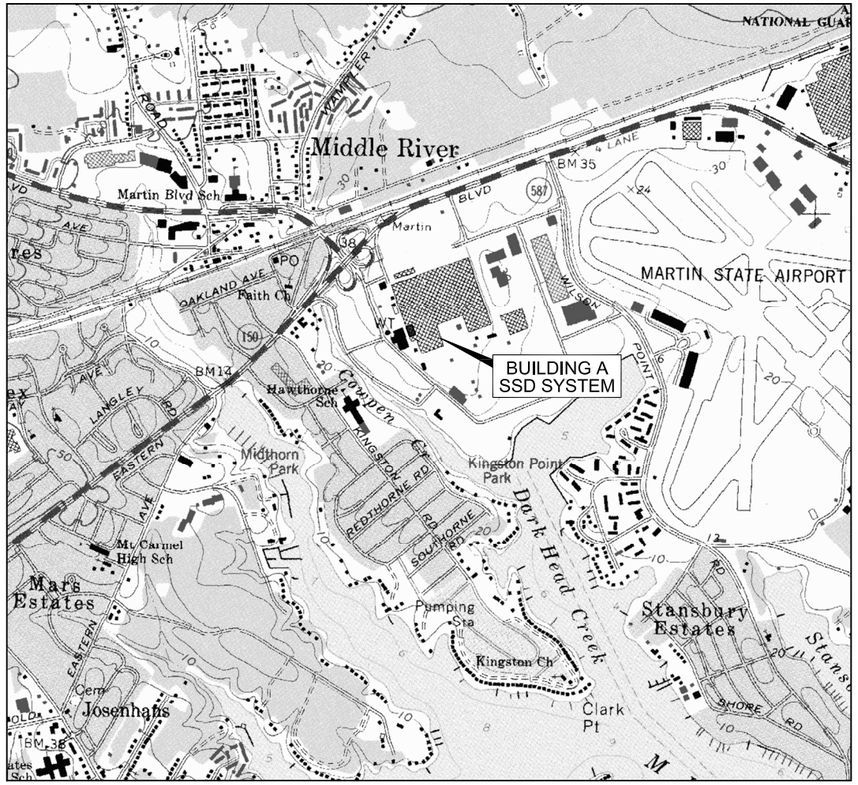
LEGEND

- SUB-SLAB VAPOR MONITORING POINT
- VERTICAL SUB-SLAB VAPOR EXTRACTION POINT
- SUB-SLAB VAPOR EXTRACTION POINT (USED IN PREVIOUS PILOT TEST)
- INDOOR AIR SAMPLING POINT
- SSD — SUB-SLAB DEPRESSURIZATION
- 4" DIA. PVC HEADER
- 6" DIA. PVC SSD SYSTEM EXTRACTION PIPING
- INDOOR AIR FILTER CONNECTION TO EMERGENCY POWER SUPPLY (FIELD RUN)
- APPROXIMATE EXISTING INFLUENCE AREA
- INDOOR AIR FILTER
- SSD SYSTEM BLOWER SKID
- EXISTING SUB-SLAB VAPOR EXTRACTION LATERAL
- PIPE SUMP
- STEEL PIPE SLEEVE (4" DIA.)
- PIPE BOLLARD (2" DIA.)
- 2.72 — INCHES OF H_2O INDUCED VACUUM MEASURED ON 6/26/2017

0 30 60 90
SCALE IN FEET

NOTE:

PIPE HANGERS PLACED NEXT TO EXISTING SUPPORT BRACKETS FOR STEEL PIPING IN CEILING APPROX. 6-12 FT APART.



SITE LOCATION MAP

0 1000 2000 3000
SCALE IN FEET

APPROVED BY:

DATE	REVISION	APRVD.

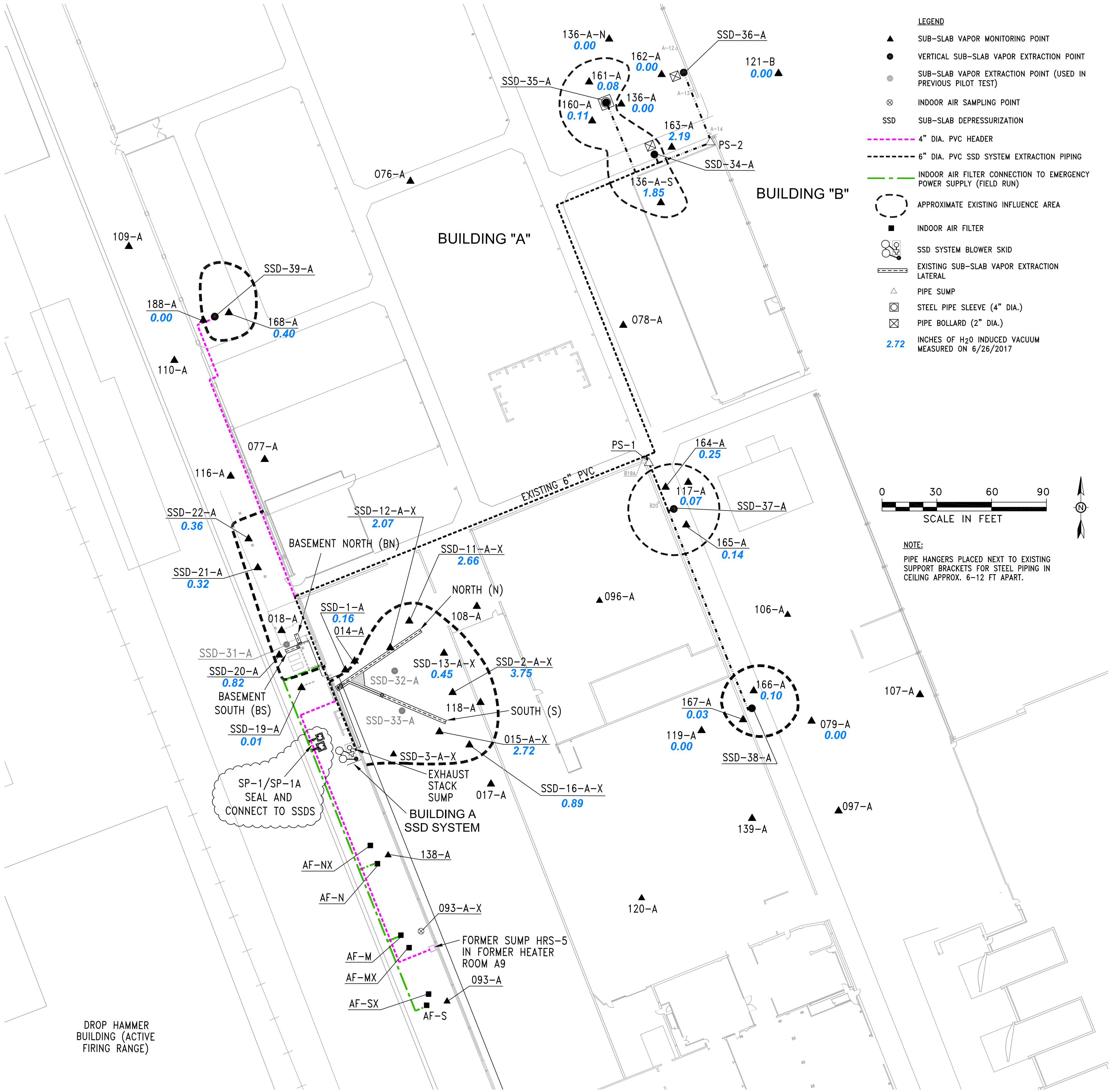
TITLE: 100% DESIGN
PLAN OVERVIEW
SSD SYSTEM FOURTH-PHASE EXPANSION - BUILDING A

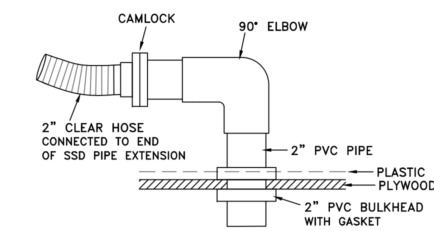
LOCATION: LMC Middle River Complex
Middle River, Maryland

TETRA TECH

APPROVED	PAR
DRAFTED	CMP
PROJECT#	117-0512524
DATE	09-02-21

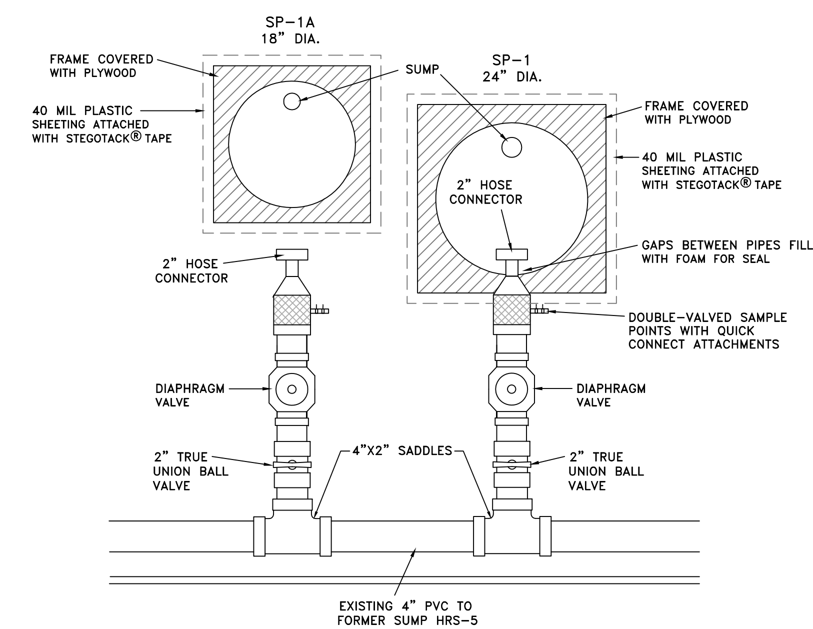
DRAWING: G1





BASEMENT SUMP SP-1/SP-1A VACUUM SEAL BULKHEAD VAPOR EXTRACTION DETAIL

NOT TO SCALE



NOTE:
RUN HOSE CONNECTING FROM PIPE TO SUMPS TO MINIMIZE WALKWAY DISRUPTION.

BASEMENT SUMPS SP-1/SP-1A VACUUM SEAL - TOP VIEW

NOT TO SCALE

APPROVED BY:	DATE	REVISION	APRVD.

TITLE:

100% DESIGN
PIPING LAYOUT AND DETAILS
SSD SYSTEM FOURTH-PHASE EXPANSION - BUILDING A

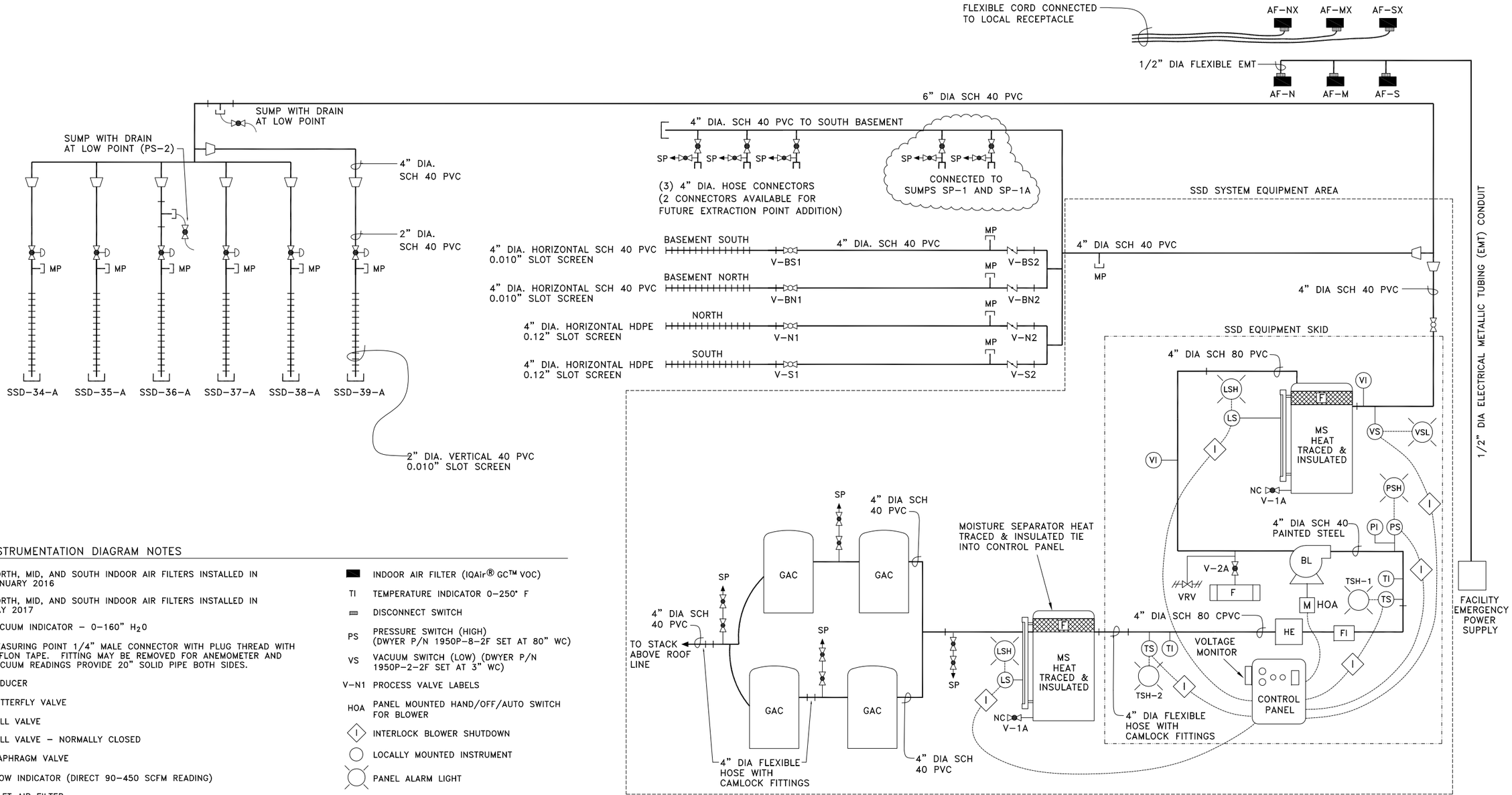
LOCATION:

LMC Middle River Complex
Middle River, Maryland

TETRA TECH

APPROVED	PAR
DRAFTED	CMP
PROJECT#	117-0512524
DATE	09-02-21

DRAWING: G2



PROCESS AND INSTRUMENTATION DIAGRAM NOTES

AF-N, AF-M, AF-S	NORTH, MID, AND SOUTH INDOOR AIR FILTERS INSTALLED IN JANUARY 2016
AF-NX, AF-MX, AF-SX	NORTH, MID, AND SOUTH INDOOR AIR FILTERS INSTALLED IN MAY 2017
VI	VACUUM INDICATOR – 0–160" H_2O
MP	MEASURING POINT 1/4" MALE CONNECTOR WITH PLUG THREAD WITH TEFLON TAPE. FITTING MAY BE REMOVED FOR ANEMOMETER AND VACUUM READINGS PROVIDE 20" SOLID PIPE BOTH SIDES.
	REDUCER
	BUTTERFLY VALVE
	BALL VALVE
	BALL VALVE – NORMALLY CLOSED
	DIAPHRAGM VALVE
FI	FLOW INDICATOR (DIRECT 90–450 SCFM READING)
F	INLET AIR FILTER
HE	HEAT EXCHANGER (XCHANGER AA–400)
MS	MOISTURE SEPARATOR (GASHO GX–100DL) WITH 40 GALLON CAPACITY, SLIGHT TUBE, REMOVABLE TOP, DRAIN VALVE
LS	LEVEL SWITCH
LSH	LEVEL SWITCH HIGH
VRV	VACUUM RELIEF VALVE – 2" (SET AT 81.6" WC)
SP	SAMPLE PORT 1/4" DIAMETER
BL	AMETEK®, ROTRON® 909BB72W 10 HP MOTOR, 300 SCFM @ 75" H_2O
PI	PRESSURE INDICATOR 0–160" H_2O
TS	TEMPERATURE SWITCH (ASHCROFT P/N T424–T05–030–XFS–150–260; TSH–1 SET AT 220° F AND TSH–2 SET AT 115° F)
GAC	GRANULAR ACTIVATED CARBON VAPOR TREATMENT (SIEMENS VENT SCRUB® VSC400, VOCARB® 48C)
	INDOOR AIR FILTER (IQAir® GC™ VOC)
TI	TEMPERATURE INDICATOR 0–250° F
	DISCONNECT SWITCH
PS	PRESSURE SWITCH (HIGH) (DWYER P/N 1950P–8–2F SET AT 80" WC)
VS	VACUUM SWITCH (LOW) (DWYER P/N 1950P–2–2F SET AT 3" WC)
V–N1	PROCESS VALVE LABELS
HOA	PANEL MOUNTED HAND/OFF/AUTO SWITCH FOR BLOWER
I	INTERLOCK BLOWER SHUTDOWN
	LOCALLY MOUNTED INSTRUMENT
	PANEL ALARM LIGHT
H	HIGH
L	LOW
SSD	SUB–SLAB DEPRESSUIZATION
M	MOTOR
EMT	ELECTRICAL METALLIC TUBING

APPROVED BY:

DATE	REVISION	APRVD.

TITLE: 100% DESIGN
PROCESS AND INSTRUMENTATION DIAGRAM
SSD SYSTEM FOURTH-PHASE EXPANSION - BUILDING A

LOCATION: LMC Middle River Complex
Middle River, Maryland

TETRA TECH

APPROVED	PAR
DRAFTED	CMP
PROJECT#	117–0512524
DATE	09–02–21

DRAWING: G3

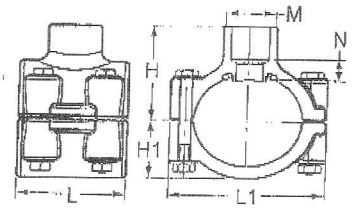
APPENDIX B—EQUIPMENT LIST AND CUT SHEETS

PVC WHITE SCHEDULE 40 FITTINGS UNIONS & SADDLES

CLAMP-ON SADDLE x SOCKET SINGLE OUTLET (continued)

Dimensions Also Applicable to
466S-XXX 466E-XXX 466SE-XXX

Pressure Rating
2" - 4" 235 psi @ 73° F
6" 200 psi @ 73° F
8" - 12" 150 psi @ 73° F



Part Number	Size	H	H1	L	L1	M	N	Approx. Wt. (Lbs.)
466-336	3x1-1/4	4-1/32	2-1/16	4-3/32	4-5/8	3	1-1/32	1.47
466-337	3x1-1/2	4-1/32	2-1/16	4-3/32	4-5/8	3	29/32	1.41
466-338	3x2	3-5/8	2-1/16	4-3/32	4-5/8	3	3/8	1.25
466-415	4x1/2	4-3/32	2-5/8	3	5-9/16	2-3/8	31/32	1.31
466-416	4x3/4	4-3/32	2-5/8	3	5-9/16	2-3/8	27/32	1.28
466-417	4x1	3-13/16	2-5/8	3	5-5/8	1-11/16	7/16	1.24
466-418	4x1-1/4	4-13/32	2-5/8	4-3/32	5-5/8	2-3/8	29/32	1.70
466-419	4x1-1/2	4-1/8	2-5/8	4-3/32	5-9/16	2-3/8	1/2	1.63
466-420	4x2	4-3/16	2-5/8	4-1/8	5-5/8	3	7/16	1.70
466-421	4x2-1/2	5	2-5/8	5-7/16	5-23/32	4-9/32	3/4	2.82
466-422	4x3	4-5/8	2-19/32	5-7/16	5-11/16	4-1/4	1/2	2.41
466-523	6x1/2	5-13/32	3-7/8	3	7-3/4	1-11/16	1-7/32	2.35
466-524	6x3/4	5-7/16	3-7/8	3	7-3/4	1-11/16	1-1/8	2.33
466-525	6x1	5-1/8	3-7/8	3	7-15/16	1-11/16	11/16	2.29
466-526	6x1-1/4	5-15/16	3-7/8	4-1/8	7-3/4	3	1-3/8	3.26
466-527[1]	6x1-1/2	5-23/32	3-7/8	4-1/8	7-31/32	3	1-1/32	3.20
466-528	6x2	5-1/2	3-7/8	4-1/8	7-3/4	3	11/16	3.04
466-529	6x2-1/2	6-7/16	3-7/8	6	7-15/16	4-1/4	1-1/8	4.75
466-530	6x3	5-15/16	3-7/8	6	7-15/16	4-1/4	25/32	4.33
466-532	6x4	6	3-29/32	6	7-15/16	5-3/16	5/8	5.12
466-573	8x1/2	8-3/32	4-7/8	8-1/2	10-1/8	5-1/4	2-3/16	9.35
466-574	8x3/4	8-3/32	4-7/8	8-1/2	10-1/8	5-1/4	2-3/4	9.36
466-575	8x1	8-3/32	4-7/8	8-1/2	10-1/8	5-1/4	2-5/8	9.37
466-576	8x1-1/4	8-3/32	4-7/8	8-1/2	10-1/8	5-1/4	2-1/2	9.39
466-577	8x1-1/2	8-3/32	4-7/8	8-1/2	10-1/8	5-1/4	2-3/8	9.32
466-578	8x2	7-11/16	4-7/8	8-1/2	10-1/8	5-1/4	1-7/8	9.17
466-579	8x2-1/2	8-1/8	4-7/8	8-1/2	10-1/8	5-1/4	1-11/16	9.24
466-580	8x3	7-1/16	4-7/8	8-1/2	10-1/8	5-1/4	1-7/16	9.15

[1] Outlet sized with bushing

Made in the U.S.A.

Asahi/America 2" PVC Type 21 True Union Ball Valve, EPDM O-rings, Socket/FPT Ends

Item #1601020

- True Union design for easier installation or repairs without expanding pipe system
- Blocked in both directions allowing valve union disassembly from either side under full pressure
- Type 21 Ball Valves carry a two-year guarantee
- Materials: PVC, CPVC, polypropylene, PVDF with EPDM, or FKM elastomer seals
- Pressure rated to 230 psi (PVC, CPVC, PVDF), full vacuum rated
- Double O-ring stem seals and blow out proof stem design for added leak protection
- Integrally molded ISO mounting pad for both manual accessory and actuation assembly
- Integrally molded base pad to surface or panel mount valves securely
- PTFE seats with elastomeric backing cushions ensure bubble-tight shut off and low cycling torque while compensating for wear
- Built-in spanner wrench on handle for valve repair
- Socket and threaded end connectors included with all ½-2" PVC and CPVC valves
- 1/2"-1" CPVC threaded end connectors are stainless steel reinforced for high temperature performance

Ball Type
Standard

Connection Type
S/FPT

Manufacturer
Asahi/America

Operator

Quantity: 1

Quote

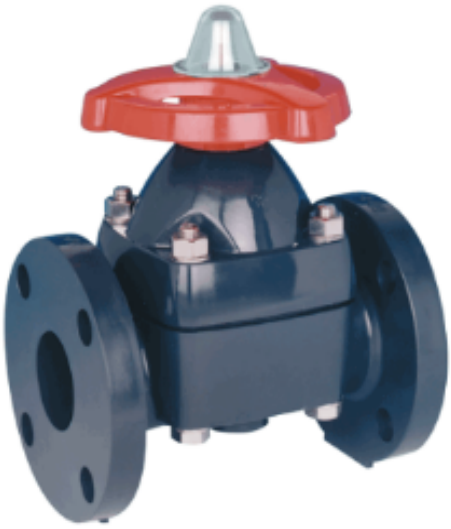
Request Information

Asahi/America Type 21 ball Valves are pressure rated up to 230 psi for PVC, CPVC, PVDF. These valves have double O-ring seals on the stem for added protection. It blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve. Asahi/America's Type 21 Ball Valves are integrally molded ISO mounting pad for both manual and actuated operations. This also makes it easy to mount valves securely or use panel mounting. The True union design creates an easy installation and repairs without expanding the system. Body flats have been added to either side of the valve body where a wrench can be applied to prevent the valve body from turing when the Union Nuts are tightened. Options for the Type 21 ball valves include: pneumatic and electric actuators and accessories, stem extensions, 2" square operating nut or "T" nut, locking and/or spring return handles, limit switches and vented balls.

End Connection	S/FPT
Manufacturer	Asahi/America
Operator	Handle
O-Ring Material	EPDM
PSI	230
Seat Material	PTFE
Series	Type 21
Size	2"
Type	True Union Ball Valve
Valve Ball Material	PVC
Valve Body Material	PVC

Related Products

Item # 400-020



Asahi/America Type-14, 2" True Union Diaphragm Valve, PVC Body, EPDM Diaphragm, Socket Ends

Item #1526020

- True Union design permits installation or repairs without expanding pipeline
- Rugged square body and bonnet are of solid thermoplastic for maximum corrosion resistance
- Uniquely designed body and bonnet together with diaphragms of new sealing designs by the state-of-the-art computer aided analysis for superior sealing
- Weir design for excellent throttling
- Full vacuum rated
- Bubble-tight sealing, even in applications such as slurries or suspended particles
- Bonnet seals to protect internals from corrosive environments
- Adjustable travel stop to prevent diaphragm from being over-tightened
- Bayonet structure to connect compressor and diaphragm for quick maintenance
- Integrally molded bottom stand for simple yet firm panel mounting
- Indicator at the top for valve position
- PVDF gas barrier, which protects EPDM backing cushion from gas permeation, is standard for all valves with PTFE diaphragm
- Low profile

Type of product

True Union Diaphragm Valve

Series

Type-14

Manufacturer

Asahi/America

Connection Type

Quantity: 1

Quote

Request Information

sealing can be achieved even in tough applications containing suspended particles or slurrys. Asahi's Type-14 diaphragm valve features a layered EPDM/PTFE diaphragm which can accept the addition of a PVDF gas barrier for aggressive chemicals such as Sodium Hypochlorite. These aggressive chemicals produce an off-gas that can permeate the typical laminated PTFE layer and actually become delaminated in this highly corrosive environment leading to a potentially hazardous situation. The Type-14's 3-layer diaphragm which includes the gas barrier layer, prevents this from ever occurring. The Type-14 diaphragm valve body is of 1-piece molded construction and is not fabricated. For maximum corrosion resistance, the Type-14 diaphragm valve's rugged body and bonnet are manufactured of solid thermoplastic materials. The Type-14 diaphragm valve can be pneumatically or electrically actuated. Typical applications: Throttling, slurry lines, chemical processing, bleach plants, aquariums, mining, water treatment, landfills, swimming pools, semiconductor manufacturing.

Body Material	PVC
Diaphragm Material	EPDM
End Connection	S
End Connection Type	Socket
Manufacturer	Asahi/America
Operator	Manual Handwheel
Seal Material	EPDM
Series	Type-14
Size	2"
Type	True Union Diaphragm Valve

Related Products

Item # 400-020

STEGOTACK® TAPE

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: FEB 18, 2020

1. PRODUCT NAME

STEGOTACK TAPE

2. MANUFACTURER

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
contact@stegoindustries.com
www.stegoindustries.com

3. PRODUCT DESCRIPTION

USES: StegoTack Tape is a double-sided adhesive strip used to bond and seal Stego® Wrap Vapor Barrier to concrete, masonry, wood, metal, and other surfaces. StegoTack Tape is a flexible and moldable material to allow for a variety of applications and installations.

COMPOSITION: StegoTack Tape is made from a blend of synthetic rubber and resins.

SIZE: StegoTack Tape is 2" x 50'. StegoTack Tape ships 12 rolls in a case.

4. TECHNICAL DATA

TABLE 4.1: PHYSICAL PROPERTIES OF STEGOTACK TAPE

PROPERTY	RESULTS
Dimensions	2" x 50'
Total Thickness	30 mil
Permeance (30 mil)	0.03 perms
Color	Grey
Material	Synthetic rubber blend
Adhesion to Steel	12.5 lb/in width ASTM D1000
Installation Temperature	40°F/110°F
In Service Temperature Range	-20°F/+140°F
VOC Content	No VOCs, 100% solids

Note: perm unit = grains/(ft²*hr*in-Hg)

5. INSTALLATION

TO WALLS: Make sure the area of adhesion is free of dust, dirt, debris, moisture, and frost to allow maximum adhesion. Remove release liner on one side and stick to desired surface. When ready to apply Stego Wrap, remove the exposed release liner and press Stego Wrap firmly against StegoTack Tape to secure.

Cut StegoTack Tape using a utility knife or scissors. Cut StegoTack Tape before removing the release liner for easier cutting. Install StegoTack Tape between 40°F and 110°F. For additional information please refer to Stego's complete installation instructions.

Continued...
Note – legal notice on page 2.

STEGOTACK® TAPE

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: FEB 18, 2020

6. AVAILABILITY & COST

StegoTack Tape is available through our network of building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' Sales Representative.

7. WARRANTY

Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided herein. Stego Industries, LLC does offer a limited warranty on Stego Wrap. Please see www.stegoindustries.com/legal.

8. MAINTENANCE

For longer adhesive life, store in dry, temperate area.

9. TECHNICAL SERVICES

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries or by visiting the website.

Email: contact@stegoindustries.com
Contact Number: (877) 464-7834
Website: www.stegoindustries.com

10. FILING SYSTEMS

- www.stegoindustries.com

Insulating Foam Sealant

GAPS & CRACKS

Ready-to-use and easy to apply, GREAT STUFF™ Gaps & Cracks Insulating Foam Sealant fills, seals and insulates gaps, providing a simple, cost-effective solution to help minimize unwanted airflow and improve energy efficiency all around the home.

WHERE TO BUY

1/5

LOWE'S 4.5 (171 Reviews)

amazon 4.5 (3758 Reviews)

Fleet Farm 4.8 (24 Reviews)

Walmart 2.0 (8 Reviews)

Product Details +

Features and Benefits +

Product FAQ −

Q. What is Great Stuff™?

A. Great Stuff™ is the brand name for a line of one-component insulating foam sealants that can help make your home more comfortable and energy efficient by sealing the gaps and cracks where air conditioned and heated air escape. Great Stuff Pro™ Polyurethane Foam Sealants can be used for both small and large air sealing and retrofit applications by DIY's or professionals. Great Stuff™ comes in cans with a straw applicator or the new patented Smart Dispenser™. Cans are in 12, 16, and 20 oz sizes. Great Stuff Pro™ series is available in larger cans (20,24, & 30 oz sizes) and use the dispensing guns to apply.

Q. Can Great Stuff™ products be used outdoors?

A. Yes.

Great Stuff™ and Great Stuff Pro™ products can be used outdoors. However, cured foam will discolor if exposed to ultraviolet (UV) light. If left exposed, the foam will eventually crumble. Paint or coat foam for best results in outdoor applications.

Great Stuff Pro™ Gasket is not approved for used outdoors

Q. How do I get Great Stuff™ foam off of my skin?

A. If the foam has not cured or hardened, use fingernail polish remover (with acetone); a polyglycol-based skin cleanser or corn oil may be effective. Then wash with soap and plenty of water. If the foam has hardened, there is no solvent that will remove it. It will not harm your skin and will wear off over time. To remove cured foam from skin, use a pumice stone (available at most drug stores) and warm, soapy water. Then apply petroleum jelly.

Q. Where can I use Great Stuff™ and Great Stuff Pro™ products?

A. Great Stuff™ and Great Stuff Pro™ products can be used in a variety of interior and exterior applications, most commonly in air sealing and home retrofit applications.

Where to use Great Stuff™ Big Gap Filler

- Exterior openings
- Hard to reach spaces
- Rim joist
- Pipe penetrations

Where to use Great Stuff™ Fireblock

- Pipe penetrations
- Exterior of electrical outlets
- Exterior of electrical penetrations
- Pipe penetrations
- Bathroom fans
- HVAC penetrations

Where to use Great Stuff™ Gaps & Cracks

- Rim joists
- Attic penetrations
- Dryer vents
- Pipe penetrations
- Sill plates
- Exterior of electrical outlets

Where to use Great Stuff™ Multipurpose Black

- Exterior of Electrical lines
- HVAC penetrations
- Small gaps and cracks in the attic or garage
- Air conditioning lines, refrigerant lines, gas lines – service penetrations
- Repair of masonry walls, sidewalks, and porches
- Outdoor landscaping applications
- RV and vehicle undercarriages3
- Trailer/transportation repairs3
- Marine sealing applications*

*Note: Great Stuff™ Insulating Foam Sealants are not for use in aviation, or food/beverage contact, or as structural support in marine applications.

Where to use Great Stuff™ Pestblock

- PVC Pipe Penetration
- Exterior of electrical cable lines
- Water faucet penetration
- Attic hatch frame
- Rim joists
- Sill plates

Where to use Great Stuff™ Pond & Stone

- Cap stones in retaining walls
- Cracks and holes in trees
- Rocks with direct water flow, such as waterfalls

Where to use Great Stuff™ Window & Door

- Doors and their rough openings
- Windows and their rough openings

Where to use Great Stuff Pro™ Gaps & Cracks

- Electrical wire penetrations
- Gas line penetrations
- Plumping and pipe penetrations

Where to use Great Stuff Pro™ Pestblock

- Under baseboards and attic hatch frames
- Hose bibs
- Dryer vents
- PVC pipe penetrations
- Plumbing penetrations

Where to use Great Stuff Pro™ Wall & Floor

- Bonding Plywood and OSB subflooring to wood joists
- Bonding foam panels, drywall, OSB and plywood to wood framing
- Bonding masonry, tile and concrete substrates to OSB, plywood, foam panels and drywall

Where to use Great Stuff Pro™ Window & Door

- Windows and their rough openings
- Doors and their rough openings

Q. What is the Great Stuff Smart Dispenser™?

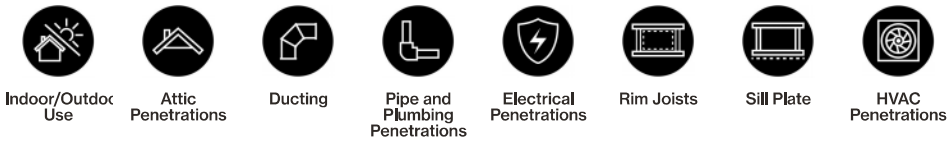
A. The Smart Dispenser™ from the Great Stuff™ brand is a game-changing, industry best dispenser for one component can sealants.

Addressing all of the pain points of standard straw dispensers, the Smart Dispenser™ uses integrated mechanical parts to improve the user experience with Great Stuff Insulating Foam Sealants:

- Reusable up to 30 days; use it again and again!
- No dripping; the foam stops as you stop, as the trigger is released the foam ceases to dispense.
- Increased precision with more control and less mess, air seal with ease with the Smart Dispenser™.

Helpful Tips +

When to Use



RELATED HOW TO PROJECTS

While you're at it, check out how other ways you can seal, insulate, and reduce energy costs in high-loss areas around your home.

View All How to Projects

Attic

Basement

Plumbing Penetrations

CHECK OUT OUR OTHER PRODUCTS

There's a solution for every seal. See what else GREAT STUFF™ has to offer.

View All Products

BIG GAP FILLER

Expands to fill gaps up to 3". Use inside or out to fill big gaps and cracks around plumbing lines and rim joists, in attics and basements, and more

WHERE TO BUY View Details

WINDOW & DOOR

A flexible, low-pressure formulation for sealing between window and door frames and their rough openings. When applied properly, it won't bend or bow the framework.

WHERE TO BUY View Details

PESTBLOCK

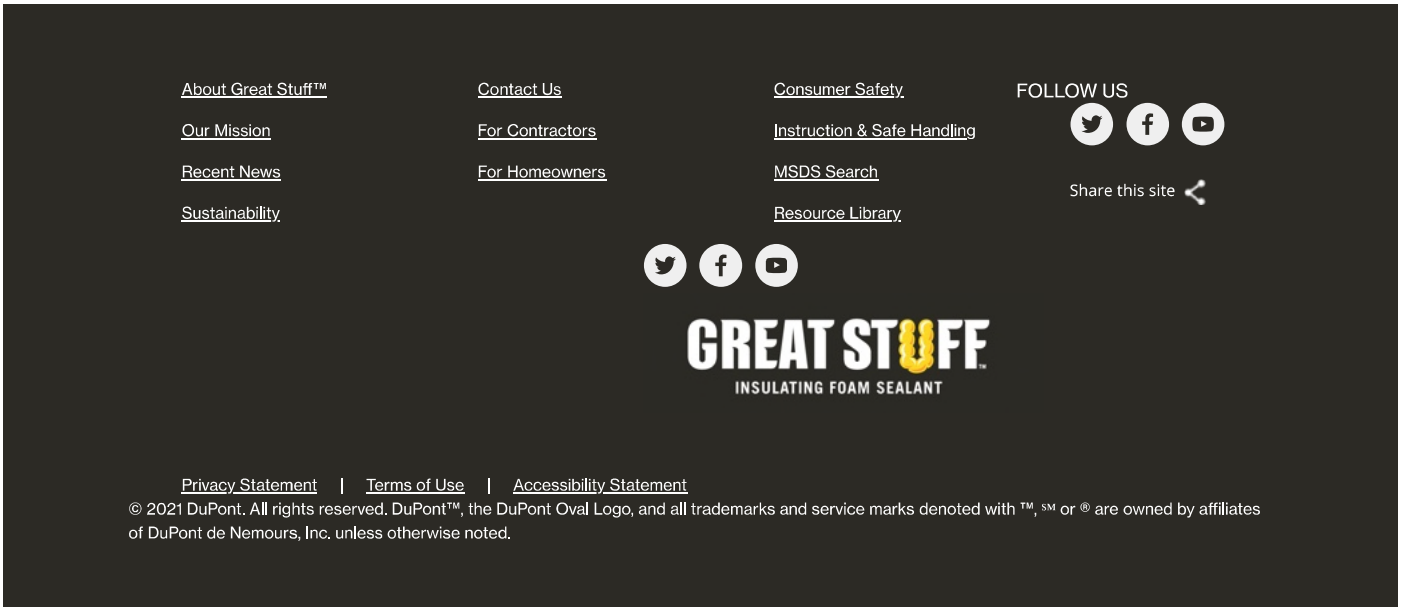
Blocks critters, pests and insects. Seals gaps and cracks up to 1" where pests typically enter such as pipe and plumbing penetrations, dryer vents and more.

WHERE TO BUY View Details

FIREBLOCK

Helps impede the spread of fire and smoke through service penetrations between floors, electrical outlets and runs through wall studs, pipe, cable, duct penetrations and more.

WHERE TO BUY View Details



https://secure.adnxs.com/seg?add=22859689&t=1

EQUIPMENT LIST AND CUT SHEETS

1. 40-mil polyethylene sheeting
2. StegoTack® double-sided tape, pea gravel, and
3. Great Stuff™ foam sealer
4. 2-inch bulkhead
5. 2–inch diameter hose quick-connect fittings
6. 2-inch diameter, clear flexible hose
7. Ball valve
8. Diaphragm valves: 2-inch-diameter construction PVC, 150 pounds per square inch (PSI) rating (4)
9. PVC piping:
    a. 10 feet, Schedule 40, 2-inch-diameter
    b. (2) 4-inch by 2-inch PVC saddles or tees
    c. Couplings, elbows, tees, caps, reducers
10. Primer: PVC primer
11. Cement: heavy bodied universal cement

APPENDIX C—FMEA DOCUMENTATION

Area	List Nbr	Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure	Sev	Causes	Prob	Detection	Det	RPN
	47	DHB - Penetrations in the Roof or Walls	Asbestos Released from penetrations made in the roof or walls	Worker exposed to Asbestos from penetration on the roof	5	Penetrating into roof or walls where asbestos is present	5	None	5	**125**
	43	Stack Stability (change to taller stack)	New stack falls	Increased health risk to workers in the building	5	Exhaust is drawn back into building through windows or intakes	3	None	5	**75**
	48	DHB - Penetrations in the Roof or Walls	Asbestos Released from penetrations made in the roof or walls	Additional Costs for abatement / schedule delay, tests, etc.	3	Penetrating into roof or walls where asbestos is present	5	None	5	**75**
	44	Stack Stability (change to taller stack)	New stack falls	Stack could fall off of building (injury or damage to vehicle/property)	5	Weather conditions - High Winds	2	None	5	**50**
	46	Not in Current Design - Drop Hammer System Failure	System shuts off (> 5 days)	Loss of Treatment Tenant Complaints	4	Power Outage Mechanical Failure (Blower)	3	Monitoring inspections (2 Weeks)	4	**48**
	10	Not in Current Design Fail-Safe Alarms - Drop Hammer	Normally-open circuits do not close properly	System would be off/down for a longer period of time.	3	Power Outage	3	None besides knowing A and C buildings lost power Check every two weeks	5	**45**
	34	Safety	Installer falls during aboveground piping installation / Roof work	Personal Injury	5	Installer error/carelessness Lack of oversight Weather (high winds/storm)	2	Visual - immediate Oversight Installation procedures JHAs	4	**40**
	41	System operation without GAC treatment	Indoor air concentrations exceed acceptable levels	Potential for Increased health risk to workers in the building	5	Exhaust may be drawn back into building through windows or intakes	2	Indoor air Monitoring performed semi-annually in Drop Hammer Building and Building A basement; annually everywhere else	4	**40**
	2	Blower - Drop Hammer	Thermal Overload Switch fails	Potential to burn out the motor (system shut down)	4	Mechanical failure	2	Quarterly inspection and maintenance of blower/equipment	4	**32**
	3	Blower - Drop Hammer	Blower fails	System not operating, no suction	4	Mechanical failure	2	Quarterly inspection and maintenance of blower/equipment	4	**32**
	4	Blower - Drop Hammer	Motor fails	System shutdown	4	Mechanical failure	2	Quarterly inspection and maintenance of blower/equipment	4	**32**
	28	Piping - Installation overhead	Material / Tools fall from overhead	Injury - Workers or Tenant	5	Installation error / carelesness / accident	2	Tailgate Meetings JHAs Project Oversight	3	**30**

Area	List Nbr	Recommended Action(s)	Responsibility & Target Completion Date (Completion Date = Mid February unless otherwise specified)	Response	Actions Taken	New Sev	New Occ	New Det	New RPN
	47	1) Review facility assessment pertaining to Asbestos and update JHAs and Workplans accordingly 1) Contact Abatement Contractor to work with subcontractor for all penetration work 2) Ensure any Asbestos containing Material is disposed of at an LM Approved Asbestos disposal site (ex: Minerva, OH) 3) Complete an Alteration Request (from Rina) for roof work, asbestos abatement, and piping and submit to LMCPI prior to start of work	1) TT - Prior to 100% Final 2) TT - Ongoing 3) TT / LMC - Prior to 100% Final						
	43	Incorporate into 100% design - support for extended stack 10-ft above roof line	TT - Prior to 100% Design						
	48	1) Review facility assessment pertaining to Asbestos and update JHAs and Workplans accordingly 1) Contact Abatement Contractor to work with subcontractor for all penetration work 2) Ensure any Asbestos containing Material is disposed of at an LM Approved Asbestos disposal site (ex: Minerva, OH) 3) Complete an Alteration Request (from Rina) for roof work, asbestos abatement, and piping and submit to LMCPI prior to start of work	1) TT - Prior to 100% Final 2) TT - Ongoing 3) TT / LMC - Prior to 100% Final						
	44	Incorporate into 100% design - support for extended stack 10-ft above roof line							
	46	- Need to be aware of shutdown within 24 hours window - Evaluate costs and pros/cons of installation of a camera monitoring system vs equipment/ auto-dialer	TT - Prior to 100% Final						
	10	- Currently, DHB system has no fail safe alarms in design - Applies if a monitoring system (auto dialer, etc.) is incorporated in the Drop Hammer system design - Incorporate same alarm setting as A and C buildings (normally closed)	TT - Prior to 100% Final						
	34	- Include Chris Keller's evaluation of the safe roof access JHA and workplan for DHB roof work (follow EO-20 command media guidance) - Consider safety precautions for	TT - Prior to 100% Final (HASP)						
	41	- Consider conducting indoor air sampling in DHB after system startup in Nov/Dec 2021	TT - 1Q 2022						
	2	- Suggest having a spare blower on site - Update Operating Plan / Spare Parts List	TT - Prior to System Startup						
	3	- Suggest having a spare blower on site - Update Operating Plan / Spare Parts List	TT - Prior to System Startup						
	4	- Suggest having a spare blower on site - Update Operating Plan / Spare Parts List	TT - Prior to System Startup						32
	28	Add language to close off work areas in Specs and HASP during overhead installations	TT - Prior to 100% Final						

Area	List Nbr	Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure	Sev	Causes	Prob	Detection	Det	RPN
	33	Power connection - DHB (Blower to power source)	Blower installed improperly	Roof damage / leak	4	Weather (heavy storms or high winds) seeping into the roof because of installation penetrations	2	Construction oversight / awareness	3	**24**
	39	Vacuum Relief Valve	Vacuum Relief Valve failed to open designed operating conditions	Thermal overload to the system and system shutdown	3	Mechanical failure	2	Bi-weekly inspections	4	**24**
	45	Waste Management	Waste Generated not disposed off at LM Approved facility or documented with a DD form	Violation of ESH-06 Potential violations of State or Federal Law	4	Inadequate planning	2	Verification with subcontractors and personnel that disposal facilities are in LM Approved list Overall sitewide waste management plan	3	**24**
	11	Not in Current Design Flow Indicator - Drop Hammer	Flow Indicator failure	Mass removal measurement will not be as accurate with the flow indicator measurement	2	Mechanical failure	2	Is not in current design Can Calculate flow in bi-weekly inspections	5	**20**
	18	Installation / Decomissioning of skid - DHB Temporary (1 month)	Improper removal / installation of electrical equipment	Severe Personal Injury/Electrical Shock	5	Not following LOTO Improper Training Worker carelessness	2	Electrical checks conducted during pre-work LOTO procedures Facility Communications / Input Tailgate Reminders prior to decomissioning / Installation	2	**20**
	30	Extraction points - installation	Utility damage while installing extraction points (drilling)	Personal Injury	5	Operator error Wrong Drilling Location Lack of oversight	2	Utility Clearance Facility Dig Permit	2	**20**
	19	Low Points Sumps - DHB	low point fills with water	system flow is reduced or eliminated from specific extraction points	3	Condensation of water from wells Heavy Rains	3	Inspection every two weeks. O&M Manual checklists will identify all checkpoints	2	**18**
	27	Piping from extraction points to system (above ground)	Pipe or joint failure	Loss of vacuum in extraction points	3	Material failure or physical damage	2	Inspection conducted every two week Tenant notification	3	**18**
	26	Piping	Utility damage while hanging pipe	Distruption of facility ops	4	Installer error/carelessness Lack of oversight	2	Visual - immediate Project oversight	2	**16**
	31	Extraction points - installation	Utility damage while installing extraction points (drilling)	Power / Utility Loss to Facility	4	Operator error Wrong Drilling Location Lack of oversight	2	Utility Clearance Facility Dig Permit	2	**16**
	35	Sample taps	Left open	release to environment	2	Operator error or occupant operator tampering	2	Every two weeks SSDS Inspection	4	**16**
	1	Balancing flow from extraction points	Reduced flow from individual points	Sub slab zone of influence could be inadequate or not according to design	3	Incorrect adjustment of valves Heterogeneity of subsurface Tubing/Piping failure (clogged, broken, etc.)	2	Flow-detectors at extraction and vapor monitoring points every 2 weeks Measuring points at each well Diaphragm valve for flow throttling	2	**12**
	5	Blower - Drop Hammer	Not getting vaccuum coverage under the building	Inadquate vaccuum at well	3	Blower undersized	2	Bi-weekly inspection of flow and vapor pin monitoring	2	**12**
	6	Dilution Filter - A / C Buildings	Valve to the dilution filter could be left open (blower ambient air valve)	Performance of system would be severely reduced due to suction through valve	3	Operator error or occupant operator bumping or tampering	2	Every two week inspection (confirmed close)	2	**12**
	7	Extraction points	Silt clogging of point	Loss of flow from these points	3	Native soil collecting into the extraction point	2	Inspection conducted every two week, flow measurement from each point, trends could detect.	2	**12**
	8	Extraction Points	Concrete Shrinkage and Cracks	Potential to have loss of vacuum and reduced capture of VOCs	3	Physical damage or intentional breach of concrete	2	- occupant contract requires notification of LMCPI to do building mods - Every two week inspection	2	**12**

Area	List Nbr	Recommended Action(s)	Responsibility & Target Completion Date (Completion Date = Mid February unless otherwise specified)	Response	Actions Taken	New Sev	New Occ	New Det	New RPN
	33	Suggest adding specifics to check roof penetrations post-construction - Update design specs	TT - Prior to 100% Final						
	39	- Add a vaccuum relief valve to design (DHB) - Update Operating Plan to include annual testing of relief valves	TT - prior to 100% Final						
	45	- Add languge to Construction Quality Control plan to ID potential waste streams and manage waste to Lockheed Martin Policy	TT - Prior to 100% Final						
	11	- Currently, DHB system has no flow indicator in design - Applies if a monitoring system (auto dialer, etc.) is incorporated in the Drop Hammer system design - Revisit if autodialer system is installed	TT - Prior to 100% Final						
	18	Confirm JHAs for specific activities reviewed prior to starting	TT - Temp System Startup and Switch to permanent System						
	30	Follow Standard procedure for facility	TT - ongoing						
	19	- Recommend inspection every week in the winter when A-Building inspections occur - Update Operating Plan	TT - Prior to 100% Final						
	27	- Install bollards per LM and tenant's preference - Evaluate scenario for pipe break / joint failure and no notification for 13 days - May need to perform indoor air sampling (SUMA canister) - Update O&M Manual as needed	TT - Prior to 100% Final						
	26	- Verify piping Run prior to installation - Tailgate discussions prior to activitiy	TT - ongoing						
	31	Follow Standard procedure for facility	TT - ongoing						
	35	None							
	1	Continue current frequency on monitoring	TT - ongoing						
	5	- During initial operations of full scale system, suggest more frequent monitoring (once a week) - Update start up plan	TT - Prior to System Startup						
	6	- Suggest exercising valve as part of annual inspection - Update Operating Plan	TT - 4Q 2021 Prior to system Startup						
	7	- Check bottom of well for material build up annually or biannually (depending on findings) - Update Operating Plan	TT - 4Q 2021 Prior to system Startup						
	8	-Based on observations recommend Use of a smoke pen to inspect cracks on the floor to detect movement of smoke in cracks to inspect how adequate the seal of the floor is (Annualy or as needed) - Communicate with occupant prior to conducting smoke pen inspection - Consider additional markings to label	TT - 4Q 2021 Prior to system Startup						

Area	List Nbr	Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure	Sev	Causes	Prob	Detection	Det	RPN
	9	Extraction points	Water accumulation in the sub slab	Reduced capture of VOCs	3	High Groundwater, plant releasing water affecting subslab, storm	2	Measurement of Flow (every 2 weeks) and applied vaccuum at extraction points and checking condensate removed from piping system.	2	**12**
	12	GAC drums - DHB Temporary (1 month)	Carbon break through	release to environment	3	- Concentrations of VOCs in sub-slab-vapor higher than anticipated in design - Supplier provides off-spec carbon	2	Effluent sampling at end of 28-day start-up period Influent vapor samples on day 2 & 14	2	**12**
	32	Power connection - DHB (Blower to power source)	Blower fails	Damage to Blower	3	Weather (heavy storms or high winds)	2	NEMA rated cabinet Bi-weekly inspections	2	**12**
	37	Startup	Functional test results don't result as designed	Schedule delay - send back faulty equipment to vendor or vendor repair on-site	3	Faulty equipment provided by vendor	2	Visual during startup Equipment testing prior to startup	2	**12**
	38	Startup	Functional test results don't result as designed	Re-design / schedule delay / cost impacts	3	Error in Design	2	Performance Testing	2	**12**
	40	Vapor Transfer lines from new point to system	Water accumulation in the lines	Reduction of air flow Reduction of system performance	2	Condensation Weather conditions (Winter)	3	Inspection of sumps every two weeks or every week in winter	2	**12**
	25	Moisture Separator - DHB Temporary (1 Month)	Operator ergo injury draining water (gravity drain)	injury	5	location of drain valve	2	Oversight - Operator Awareness Operating Procedures / JHA	1	**10**
	42	System operation without GAC treatment	Permit limits are exceeded	Notice of violation	5	Extracted concentrations exceed expectatations (20 lb/day)	1	SSDS effluent concentrations measured [2 & 14 days during startup ; quarterly during normal operations]	2	**10**
	22	Moisture Separator - DHB Temporary (1 Month)	Level Switch High fails to indicate high water with MS (float switch)	Flood the blower (amperage overload on the blower) Shut system down	4	Mechanical failure	2	- Testing and Visual inspection at startup - Weekly visual inspection (sight glass)	1	**8**
	36	Skid - DHB Temporary (1 month)	Damaging new skid during unloading/installation	Possible repair work for skid Schedule delay (~1 wk)	2	Loading equipment not suited for purpose Operator error	2	Visual inspection of skid pre/during unloading/installation Project oversight Qualified Operator requirement	2	**8**
	13	GAC drums - DHB Temporary (1 month)	Seal on the rim fails	release to environment	3	Manufacturer defect (not sealed properly)	2	- Drum inspection prior to startup (soap test) - Weekly visual inspection	1	**6**
	14	Hose to GAC - DHB Temporary (1 month)	Hose failure (crack or fatigue)	release of untreated air to environment	3	stress points (short radius bends)	2	- Soap test and connections to fittings at Startup - Visual inspection at startup and every two weeks	1	**6**
	15	Hose to GAC - DHB Temporary (1 month)	Camlock connection fails	release of untreated air to environment	3	Operator error or occupant operator tampering	2	- Testing and visual inspection at startup - Cotter Pins to ensure camlocks are in place. - Zip ties installed to prevent tampering)	1	**6**
	16	Hose to GAC - DHB Temporary (1 month)	Camlock barb and hose joint failure	release of untreated air to environment	3	wear or over tightening	2	- Testing and Visual inspection at startup - Weekly visual inspection - Hoses replaced as necessary	1	**6**
	17	Hose to GAC - DHB Temporary (1 month)	Material incompatibility between PVC, CPVC and aluminum fittings	release of untreated air to environment	3	wear or over tightening	2	- Testing (soap) and Visual inspection at startup - Weekly visual inspection - Hoses / piping replaced as necessary	1	**6**

Area	List Nbr	Recommended Action(s)	Responsibility & Target Completion Date (Completion Date = Mid February unless otherwise specified)	Response	Actions Taken	New Sev	New Occ	New Det	New RPN
	9	Continue current frequency of flow monitoring for the new system	TT - ongoing						
	12	- Suggest additional effluent sampling on day 14 in addition to day 28 - Update Start up Plan	TT - Prior to 100% Final						
	32	None							
	37	None							
	38	None							
	40	None							
	25	Reminders and JHAs Review prior to activity	TT - ongoing						
	42	None							
	22	None							
	36	None							
	13	- Ensure project team is following startup plan and all testing and visual inspection	TT - System Startup						
	14	- Ensure project team is following startup plan and all testing and visual inspection	TT - System Startup						
	15	- Ensure project team is following startup plan and all testing and visual inspection	TT - System Startup						
	16	- Ensure project team is following startup plan and all testing and visual inspection	TT - System Startup						
	17	- Ensure project team is following startup plan and all testing and visual inspection	TT - System Startup						

Area	List Nbr	Item / Function	Potential Failure Mode(s)	Potential Effect(s) of Failure	Sev	Causes	Prob	Detection	Det	RPN
	20	Measurement Vacuum Suction - DHB	Faulty gauge used for Vacuum Measurement (weekly)	Incorrect adjustments to the system (area of influence would potentially be set incorrectly)	3	Mechanical failure	2	Multiple measurement points for gauge. Historical Data for comparison Operator should know that gauge is faulty	1	**6**
	21	Moisture Separator - DHB Temporary (1 Month)	Drain Valve on Moisture Separator left open	potential to release contaminated air and water to environment	3	Operator error or occupant employee tampering	2	- Testing and Visual inspection at startup - Weekly visual inspection	1	**6**
	23	Moisture Separator - DHB Temporary (1 Month)	Break of sight glass on Moisture Separator	potential to release contaminated air and water to environment	3	Operator error or occupant operator tampering or accident	2	Weekly Inspections Communications to Emlpoyees in area	1	**6**
	29	Piping from point to system	Inadvertent closing of the valve	No suction and removal of sub slab VOCs (ineffective system)	3	Operator error or occupant tampering	1	Inspection conducted every two week Locked valve	2	**6**
	24	Moisture Separator - DHB Temporary (1 Month)	MS water stored in 5 gallon pail could get knocked over	Release of potentially contaminated water to environment	2	Operator error or occupant operator tampering	2	Operating Procedures	1	**4**

Area	List Nbr	Recommended Action(s)	Responsibility & Target Completion Date (Completion Date = Mid February unless otherwise specified)	Response	Actions Taken	New Sev	New Occ	New Det	New RPN
	20	- Have access to spare gauge as necessary	TT - Prior to Inspections						
	21	None							
	23	Suggest whatever best orientation is to keep away from traffic	TT - prior to startup						
	29	None							
	24	None							

APPENDIX D—BUILDING A SSD SYSTEM CHECKLIST

PRE-STARTUP EQUIPMENT INSPECTION CHECKLIST

SUB-SLAB DEPRESSURIZATION SYSTEM FOURTH-PHASE EXPANSION

Building A, Middle River Complex, Middle River, Maryland

ITEM	YES/NO/NA	COMMENTS
Sump SP-1 Vaccum Seal Installation		
Sump seal installed as required?		
Bulkhead and hose fittings installed as required?		

Sump SP-1A Vaccum Seal Installation		
Sump seal installed as required?		
Bulkhead and hose fittings installed as required?		

ITEM	YES/NO/NA	COMMENTS
Sump SP-1 Piping		
Piping installed as required?		
Pipe supports installed?		
Valves installed as required and operational?		
Valve locks installed as required? *(Master Lock 6 ft. adjustable cable lockout device or similar)*		
Sample/Measuring points installed as required? *(Below diaphragm valves at each extraction well; 1/4" NPT with Teflon tape)*		
Extraction piping properly tied into header pipe? *(PVC Saddles, Schedule 40 clamp-on saddle x socket single outlet type)*		

PRE-STARTUP EQUIPMENT INSPECTION CHECKLIST

SUB-SLAB DEPRESSURIZATION SYSTEM FOURTH-PHASE EXPANSION

Building A, Middle River Complex, Middle River, Maryland

ITEM	YES/NO/NA	COMMENTS
Sump SP-1A Piping		
Piping installed as required?		
Pipe supports installed?		
Valves installed as required and operational?		
Valve locks installed as required? *(Master Lock 6 ft. adjustable cable lockout device or similar)*		
Sample/Measuring points installed as required? *(Below diaphragm valves at each extraction well; 1/4" NPT with Teflon tape)*		
Extraction piping properly tied into header pipe? *(PVC Saddles, Schedule 40 clamp-on saddle x socket single outlet type)*		

ITEM	YES/NO/NA	COMMENTS
Miscellaneous		
As-Built Drawings submitted?		
Summa canisters on-site for process vapor sampling if required per current system sampling schedule? *(One, 1-liter canister for TO-15 analysis of influent sample)*		

Tetra Tech Rep: Name _____ Signature _____ Date _____

S&S Tech Rep: Name _____ Signature _____ Date _____