Silfab Solar SC

Risk Management Plan

RMP

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8/30/24

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1.0 Introduction

1.1 Overview

Silfab Solar manufactures PV Cells at its SC facility. This is accomplished by starting with a silicon oxide wafer, inspecting it, cleaning it, texturizing it, coating it several times, attaching a conductive grid, then testing it, to ensure that it performs per design. The manufacturing activities are conducted within the building's 785,000 sqft interior which houses the "cleanroom" that encompasses approximately 140,000 sqft of the total space and holds the tools necessary to complete this work. The final products are then packaged and sold to outside organizations or used in the Silfab module production process, to produce solar panels.

1.2 Regulatory Requirements

The Silfab Solar SC Risk Management Plan (RMP) has been developed in compliance with EPA requirements under 40 CFR 68, Chemical Accidental Prevention Provisions. The Silfab Solar SC Plant is subject to these requirements because it exceeds the 10,000-pound on-site storage threshold quantity, for Hydrochloric Acid CAS# 7647-01-0, Anhydrous Ammonia CAS# 7664-41-7 and Silane CAS# 7803-62-5, which are chemicals identified as extremely hazardous by the Unities States Environmental Protection Agency (USEPA).

It has been determined that the Silfab Solar SC facility qualifies as a Level 3 facility due the types and quantities of the chemicals that will be on site and the fact that these chemicals will also trigger a PSM (Process Safety Management) program requirement. Worst case scenario modeling was done using the EPA RMP*Comp for two of the previously listed materials, Anhydrous Ammonia and Silane and will be discussed further on, in this narrative.

2.0 Facility Description

2.1 Plant Layout

The facility is laid out so that the chemical receiving, storage and distribution systems are all located outside of the main building on the North side of the structure. There are three auxiliary buildings which house the central utility plant, the ultrapure water treatment system, the wastewater pretreatment system and the wet chemical distribution system, and the TMA distribution system. The

spec gases are located to the East of these buildings, on the North side of the main structure and can be seen on the site map in Appendix C – Chemical Holding Area.

2.2 Chemical/Gas Offloading

The hydrochloric acid is received by tanker trailers and offloaded on the chemical offloading pad located just outside of the chemical distribution building. The specially designed pad, is capable of holding the entire contents of one tanker trailer (approximately 6500 gallons) in case of a spill. The pad is also equipped with a sump, so that collected material can easily be pumped out to either the wastewater pretreatment system or to another tanker truck for off-site treatment and disposal. The wet chemicals are offloaded via hoses connected to pump boxes, piped to the appropriate chemical holding tanks. Hoses are color coded with special connectors to prevent chemicals from being cross contaminated. The driver delivering the chemical will make the connections of the hose to the truck and the offloading pump. The Silfab facility tech will ensure the available capacity of the receiving tank and ensure that the valving is set up properly to receive, before starting the transfer pump.

Silane is delivered in specially designed tube trailers that carry the silane in CGA certified cylinders. The silane trailers are staged on pads, specifically designed for silane use. The pads are equipped with 4" concrete walls on three sides of the pad, allowing one open end for the placement and removal of the silane trailers. The pads are also equipped with an overhead fire suppression system that will automatically operate if a fire is detected. The pads also have TGMS detection units as well as UVIR detection units that will automatically shut down the system if a leak is sensed. Connections are made from the trailer to the distribution system via a stainless-steel braided hose which is connected and disconnected by the silane delivery person. The Silfab facilities techs will ensure the connections are made properly before starting the purge and pressure checks built into the silane delivery system. Several steps are involved, and all must be completed successfully, before the silane leaves the tube trailer.

Ammonia is delivered via isotainers and is held on a pad equipped with scale units that monitor the ammonia usage based on weight. The pads are equipped with overhead fire suppression systems that will automatically activate if a fire is detected. TGMS detection units are stationed on the perimeter of the pad and above the pad to identify any leaking material, and if detected, will automatically shut down the ammonia feed system. Connections from the isotainers to the distribution system are made by the ammonia delivery drivers. The Silfab facilities technician will ensure the connections are made properly before starting the purge and pressure checks built into the ammonia delivery system. Several steps are involved, and all must be completed successfully, before the ammonia leaves the isotainer.

2.3 Chemical/Gas Storage

The Wet Chemical Distribution Building houses two hydrochloric acid tanks, each, with a 30,000L capacity. The building itself acts as a secondary containment and can hold 110% of the contents of one of the acid holding tanks. The HCl bay is also supplied with a sump that is piped back to the WWPT system, in case any material leaks out of the tank or lines. The sump can also be used to assist in pumping out the containment, if material has to be collected and transported for outside treatment and disposal.

The tanks are supplied with vents that are tied to the acid scrubber exhaust and are vented as such, during filling operations. Along with this, the tanks are padded with nitrogen during normal operations to minimize any off gassing. Level sensors that identify high and high-high levels are installed in the tanks and connected to the central panel that has both an audio and visual alarm notification.

The silane gas is held in the specially designed trailers that are stationed on concrete pads on the North side of the process building. The pads are outfitted with 4" concreate walls on three sides of the trailer for safety reasons, in case the systems malfunction. The pads are equipped with UVIR and Toxic Gas monitoring devices. The devices are interlocked to the silane feed system, so that if a leak is detected, it will shut off the silane flow at the pad. The pad has a canopy that covers the automatic water spray fire suppression system, which will activate if any fire is detected.

The ammonia gas is held in isotainers specifically designed for the purpose. The pad is also equipped with toxic gas and UVIR detection units that will shut off the supply of the ammonia, if any leak is detected. The pad also has an awning that covers the automatic fire suppression system. This system will activate if any leak is detected by the UVIR or TGMS systems. Visual and audible alarms are also stationed near the pad to warn personnel that a leak has been identified.

2.4 Manufacturing Process

There are several steps in the PV Cell manufacturing process, among which is the cleaning and texturizing step where the hydrochloric acid (HCl) is used. The HCl is pumped from the holding tank via double contained PFA tubing , to a valve manifold box (VMB) header, which then distributes the HCL to the specific tools, when the tool opens its valve and calls for it. The HCL is then diluted with water to form a "bath" for the silicon wafers to be cleaned. The system works on a blead and feed system based on pH levels. The wastewater from the bath drains to an external sump, which then pumps to the on-site wastewater pretreatment system.

Silane is fed from the silane tube trailer to the VMBs, via double contained stainless steel tubing. The VMBs distribute the silane to the PECVDs and LPCVDs as needed and called for by the specific tools. The silane is used to create a hardened silicon layer on the PV cell surface which helps to protect the PV

cell and increases light absorption leading to higher power output. The majority of the silane is consumed in the tool for the process and residual gases are collected in an exhaust duct that feed to the facility's direct fire thermal oxidizer (DFTO) where the remaining gases are burned off. The exhaust flow then passes through a venturi scrubber to remove the particulates formed, as a result of the silane combustion. The venturi scrubber exhaust is then fed through the acid scrubber before being released to the atmosphere.

Ammonia is fed from the ammonia isotainers to the VMBs, via double contained stainless steel tubing. The VMBs distribute the ammonia to PECVDs, as needed, where it is used to create a silicon nitride anti reflective coating with the silane. The coating helps to retain the sunlight for additional light absorption equaling higher output in the finished product. Again, most of the ammonia gases are consumed in the tool and residual gas left in the exhaust is fed through a plasma scrubber with a destructive removal efficiency of 99% before passing through the acid scrubber prior to being released to the atmosphere.

2.5 Plant Drainage

Much of the area directly outside the building is paved with either asphalt or concrete and the general grade of the property is from East to West. Drain receivers are primarily located against the curbed areas and are piped so that runoff flows to the detention ponds located on the South side of the main property, the Southwest corner and the Southeast corner of the property respectively. The detention ponds are equipped with high overflow drain ports and manual bypass drain valves.

2.6 Plant Security

The property is protected mainly by the natural topography. The North side of the building is protected by a steep retaining wall and the South and West side of the building are protected by steep hills. There are fences on both the North and South side of the building that extend beyond the paved areas to protect equipment and material from being accessed by non-personnel. Security cameras are both outside and inside the main building for additional protection and the main building is equipped with a monitored security system.

2.7 Land Use

The site is located on land zoned as Light Industrial, along with other light industrial buildings, in Fort Mill, SC 29715. Other structures within the plant vicinity include residential housing, strip malls with restaurants, grocery stores and small businesses and a public school. (See Appendix A)

3.0 Worst-Case Release Scenario

3.1 Description

There are two worst-case scenarios for the Silfab Solar SC facility due to having material falling under different categories, based on EPA designations for flammability (Silane) and toxicity (Anhydrous Ammonia).

The first, worst-case scenario, is assuming a catastrophic failure of a full, silane tube trailer, which would result in 13000 lbs. (2200 gal) of silane being released and resulting in a vapor cloud explosion. Using the EPA's RMP*Comp, the facility data was entered, and the calculations were run to determine the overpressure endpoint distance, to be mapped out from the source. The overpressure endpoint is 1.0 psi, which is the pressure specified for the regulated substance, silane, under the RMP rule. The radius of the affected area was determined to be 0.2 miles, and the area is shown on the attached map for the Silane Worst-Case Calculation Summary in Appendix D.

The second, worst-case scenario, is assuming a catastrophic failure of a full isotainer of anhydrous ammonia, which would result in 22,000 lbs. of ammonia being released. Using the EPA's RMP*Comp, the facility data was entered, and the calculations were run to determine the distance to the toxic endpoint from the source so that it could be indicated on a map. The toxic endpoint radius was determined to be 1.2 miles, which is the downwind distance to the toxic endpoint specified for the regulated substance (anhydrous ammonia) under the RMP rule. The radius of the affected area is shown on the attached map for the Anhydrous Ammonia Worst-Case Calculation Summary in Appendix D.

3.2 Off-Site Consequence Analysis

In the previously stated, worst-case scenario for silane, the radius of the affected area was determined to be 0.2 miles, or 1,056 ft, from the occurrence location, being the silane pad. Based on these results, the vapor cloud explosion would extend beyond the property line furthest, on the North side of the building, to approximately 906 ft. On the South side of the building the affected area extends past the property line approximately 150 ft and approximately 360 ft on the East end.

Regarding the aforementioned worst-case scenario for anhydrous ammonia, it was determined that the toxic endpoint, resulting in concentrations of ammonia at 0.14 ppm, would be 1.2 miles. This extends well beyond the confines of the property and it's unlikely that people will even be able to detect it at

these concentrations however, these are the concentrations designated by the EPA under the RMP rule for this application.

4.0 Alternative Release Scenarios

4.1 Description

Although, the occurrence is unlikely, under the EPA's RMP rule, worst-case scenarios must be modeled for the regulated substance falling under the EPA requirements. However, the EPA allows for a more likely scenario to be modeled, as well, for the regulated substances, known as the alternative release scenario. The alternative modeling was done for both silane and anhydrous ammonia and shows a much different outcome than the worst-case scenarios previously discussed, for both substances. While a worst-case scenario for hydrochloric acid was not modeled, it is required for all class 3 facilities to model an alternative scenario for all, on site toxic substances, falling under the RMP rule, therefore, the alternative scenario for hydrochloric acid is also included below.

In the alternative scenario for silane, it is assumed that the contents of one cylinder or approximately 1,654 lbs. of silane have leaked out, thereby forming a vapor cloud explosion. With the use of the EPA's RMP*Comp, the facility data was entered, and the calculations were run to determine the same 1.0 psi over pressure endpoint distance from the source location. This time, the distance was calculated to be a 0.06-mile radius, which is shown on the map attached to the Silane Alternative Calculation Summary in Appendix D.

In the alternative scenario for anhydrous ammonia, it was assumed that the connection hose between the isotainer and the process delivery system began to leak and the response time to get the issue under control was 35 minutes, thereby resulting in approximately 105 lbs. of ammonia to be released. Again, the toxic endpoint concentration 0.14 ppm was used, and the radius of the affected area was calculated to be 0.1 miles with the use of EPA's RMP*Comp tool. However, according to the EPA RMP requirements, this distance must be recorded as 0.1 miles, and it is so indicated on the map attached to the Anhydrous Ammonia Alternative Calculation Summary found in Appendix D.

The alternative scenario for hydrochloric acid was modeled by assuming a release of 43.4 lbs. or approximately 4.4 gallons of 37% HCl. The toxic end point concentration used was 0.03 ppm and the downwind distance was estimated to be 0.1 miles or the minimum distance for toxic substances under the RMP rule. The numbers were confirmed with the use of the EPA's RMP*Comp tool and the summary, with the map showing the affected area, can be found in Appendix D.

Though not required due to its 49% concentration and falling below the 50% concentration requirement, and alternative scenario was completed for hydrochloric acid at the 50% concentration level. The modeling assumed a hydrofluoric acid release of 23.9 lbs. or approximately 2.5 gallons. A 0.016 ppm toxic endpoint was used resulting in a 0.1 mile radius of affected using the EPA's RMP*Comp tool. The summary of the results and the mapped area can be found in Appendix D.

4.2 Off-Site Consequence Analysis

In all four of the alternative scenarios for silane, anhydrous ammonia, hydrochloric acid, and hydrofluoric acid, the affected radius extended beyond the Silfab Solar property line on the North side of the building, primarily due to the proximity of the source material staging area, to the Northern property line. However, the distance beyond the property line is to a much lesser extent than what was determined for the worst-case scenarios for both the silane and anhydrous ammonia.

5.0 Public Receptors

Silane – In both scenarios for silane (Worst-Case and Alternative) the affected area exceeded the limits of the Silfab Solar property boundaries. For the worst-case scenario, the public receptors included businesses to the North and to the East of the main Silfab Solar manufacturing building. These businesses included Ross Distribution and Motion Industries, both of which are included as contacts for emergencies in the Silfab Solar Facility Emergency Action Plan (FEAP).

The affected area for the Alternative Scenario for Silane only extended beyond the property line on the North side of the main manufacturing building. This again would include Ross Distribution who has been included in the Silfab Solar Facility Action Plan (FEAP) as contacts in the event of the Silfab Solar emergency.

Anhydrous Ammonia – Here again, in both cases the (Worst-Case and Alternative) affected areas, based on the modeling, extend beyond the borders of the Silfab Solar property. For the worst-case scenario, public receptors include businesses, shopping centers, residential areas, and public schools. It was estimated that approximately 1,900 residents would be in the affected area, utilizing a toxic endpoint concentration of 0.14 ppm. Again, these are extremely conservative results, considering a popular glass cleaner contains concentrations at 350,000 times this amount. The Silfab Solar Facility Emergency Action Plan (FEAP) identifies the necessary public emergency responders to contact in case of an anhydrous ammonia leak. The public emergency responders are necessary because Silfab solar has no authority over the public. The contact list for emergencies include; York County Department of

Emergency Management, Flint Hill Fire Department, York County Sheriff's Office, The LEPC, neighboring businesses Ross Distribution and Motion Industries and the Fort Mill Schools Superintendent.

In the Alternative Scenario for Anhydrous Ammonia, the affected area extends beyond the property lines only on the North side of the main building, which is mainly due to the staging location of the ammonia in relations to the North property line. Based on the toxic endpoint concentration of 0.14 ppm, Ross Industries would be impacted. Again, Ross Industries' contact information is included in the Silfab Solar FEAP, in case of a Silfab Solar emergency.

In the case of the alternative scenario for hydrochloric acid, and hydrofluoric acid the affected areas extend beyond the Silfab Solar property line on the North side of the building, mainly due to the proximity of the acid holding tanks, to the northern property boarder. In these scenarios a portion of the Ross distribution center falls within the affected area. The proximity of the Ross distribution center was considered during the development of the Silfab Solar Facility Emergency Action Plan (FEAP) and Ross emergency contact numbers are incorporated into the FEAP.

6.0 Five Year Accident History

Since being on site starting in 2023 Silfab Solar has not had an off-site release of silane, anhydrous ammonia, or any other chemical the facility uses for their production, nor has it had any on-site RQ releases or spills.

7.0 Emergency Preparedness and Coordination with Local Emergency Response Officials

7.1 Emergency Response Planning and Training

The Silfab Solar Facility Emergency Action Plan (FEAP) identifies the roles and responsibilities of plant personnel in the event of an emergency. The Facility Director is responsible for ensuring the required agency notifications are completed, if required, in the event a chemical emergency (spill or release) situation occurs at the Silfab Solar SC site. In the absence of the Facility Director the Emergency Coordinator may assume these responsibilities.

The Silfab Solar Facility Emergency Action Plan (FEAP) is based on the principles and concepts established under the National Incident Management System (NIMS) and establishes the guidelines and overall policies and procedures related to emergency situations while incorporating the Incident

Command System (ICS) to identify departments or individuals responsible for emergency planning, preparedness, response and recovery. This same concept is also incorporated into the Emergency Operations Plan established by the York County Office of Emergency Management. By mirroring this framework, transition of responsibilities between site personnel and public emergency responders, in the event of an emergency, is seamless.

The Silfab facility has the following on site, Emergency Response Teams: Emergency Evacuation Team, Medical Emergency Response Team (MERT), HAZMAT response Team, and Incipient State Fire Extinguisher Personnel. All participants have been trained with specific instruction to ensure they are qualified for their roles and duties, and annual refresher training will continue for plant personnel.

7.2 Coordination with Local Emergency Responders

The Silfab Solar SC facility personnel have met with the York County Department of Emergency Management, The Flint Hill Fire Department, the LEPC, members of the Fort Mill School Board, and other local officials to discuss plant operations and emergency procedures including, the review of the Silfab Solar SC FEAP. Plans were discussed for future on-site training with representatives from each of the respective groups. The facility retains a close relationship with these groups and is currently scheduled for joint HAZWOPER training with members of the Flint Hill Fire Department.

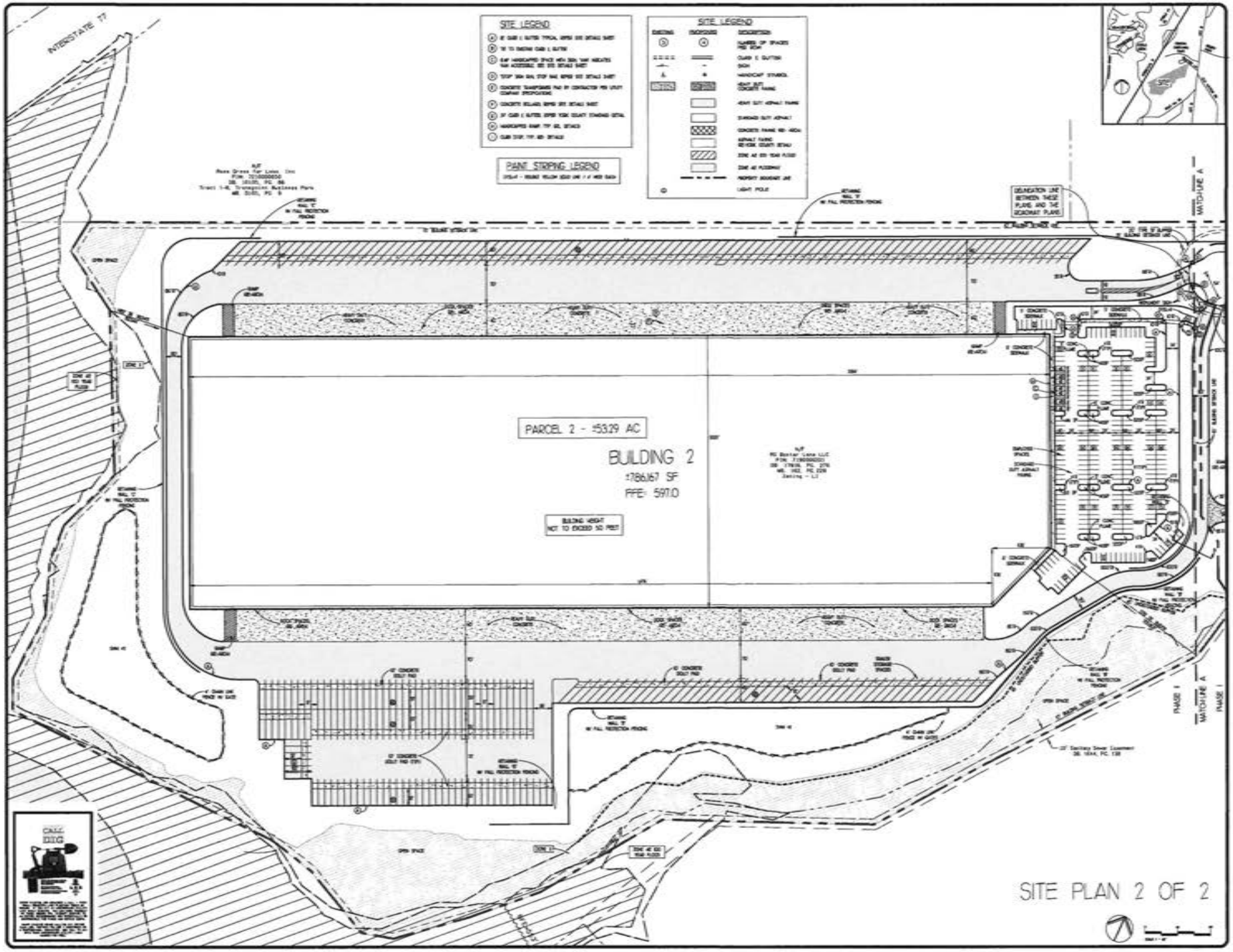
Appendix A

Vicinity Map


Steele Creek
Oxco, Inc
Proline
&T Alteration
and Cleaners
Clothing
alteration service
The Flipside Cafe
Metrolina
Collision Center
Element Designs
The Trailer Store
Concession
Trailers & Sheds
Silfab
Steele Creek
Google

Appendix B

Facility Site Plan



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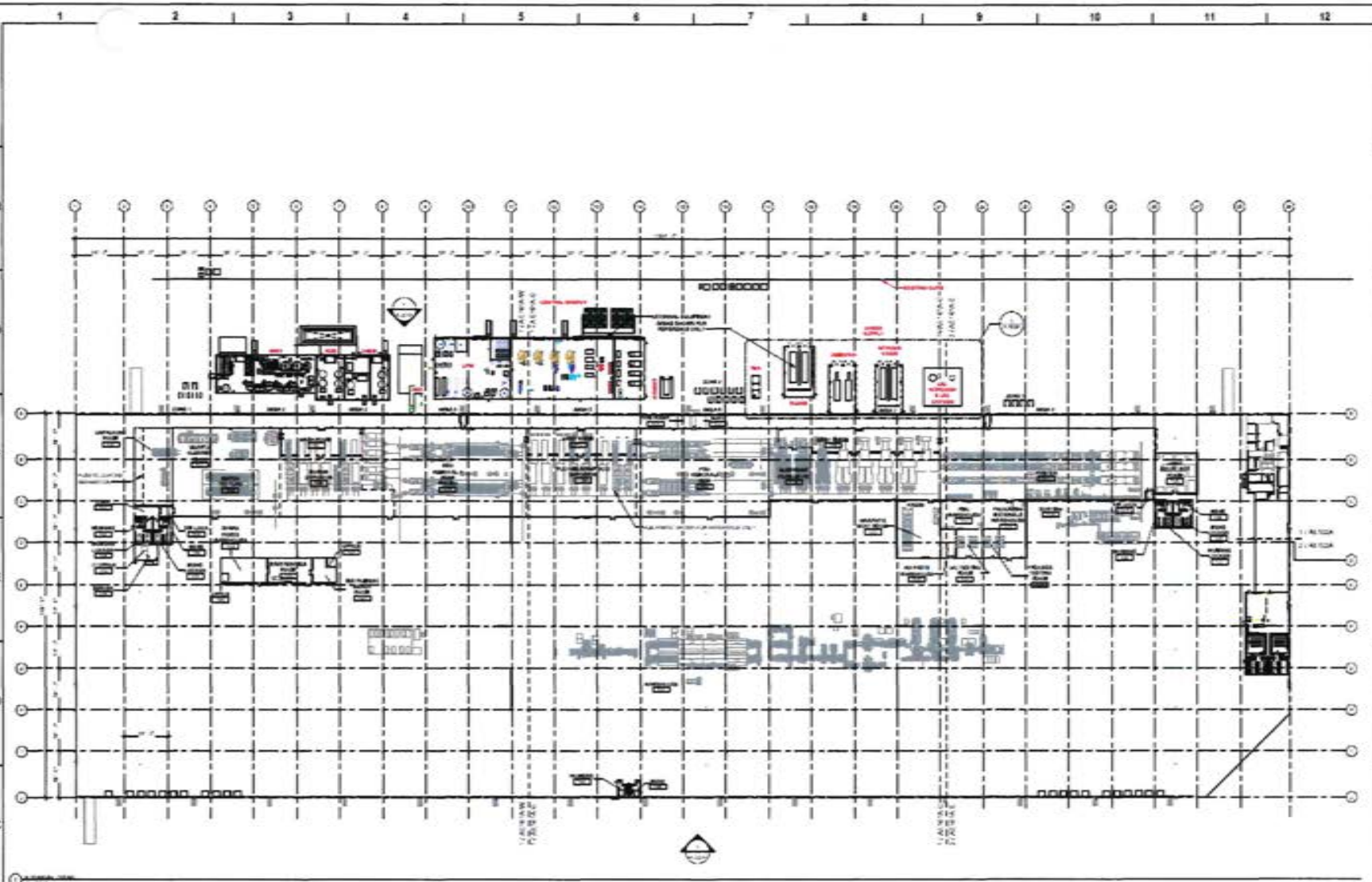

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FLOOR PLAN -

Appendix C

Chemical Holding Area

The wet chemical holding tanks are located in a building outside of the main production building. HCl holding tanks are located here. Silane is located here, on the Silane pad.