TAB 06 SAFETY PLAN

For this submittal, the following safety plan is applicable to all proposed stations. While our proposal includes two station designs (C-100 and HyAC), the design, operation, review and project safety aspects are sufficiently similar to be covered under this Plan.

1. Scope of Work for the Safety Plan

Air Liquide brings our own comprehensive Industrial Management System (IMS) to all projects. This system applied worldwide within Air Liquide underlies every facet of our operation from Risk Assessments and HAZOP reviews, to Management of Change, to Procurement controls, Operations and Maintenance Procedures, and Auditing for compliance. IMS is deeply ingrained in Air Liquide, and it is a major force behind our culture of high safety standards, system design and operational excellence.

2. Organizational Safety Information

Air Liquide uses a global industrial management system that guides operating entities on how to conduct industrial operations safely and reliably. An overview of the structure is shown below:

Key Elements to be covered by Group Procedures	GROUP PROCEDURES				
Group Policy	GP0 - The Industrial Management System	GP1 - Industrial Regulatory Compliance			
Document Control	GP02 - Document Implementation and Control				
Design	GP03 - Devl, Des, Mfg & Inst				
Industrial Risk Management	GP04 - Industrial Risk Management	GP05 - Crisis Management			
Health, Safety & the Environment	GP06 - Occupational Health, Safety & Environmental Management				
Training & HR	GP07 - Training	GP08 - Qualification			
Operations & Maintenance	GP09 - Ready for Start Up Reviews	GP10 - Operations: Production Management	GP11 - Operations: Maintenance Management	GP12 - Procurement	GP13 - Management of Change
Measurement & Reporting	GP14 - Acident & Incident Reporting & Analysis Investigations	GP15 - Industrial Reporting			
Audit	GP16 - Industrial Audit				
Management Review	GP17 - Management Review				

Air Liquide maintains a world class safety program. The culture of safety at Air Liquide is anchored in our 12 Life Saving Rules. Every employee certifies annually that he or she will apply the Life Saving Rules to all their day to day activities at Air Liquide. Air Liquide also maintains a Stop Work Authority program which empowers all employees to stop any work activity they feel compromises the safety of an individual or facility. The work must be reviewed by management and an updated work plan implemented with agreement of all affected individuals.

Organizational Policies and Procedures

Air Liquide has developed policies and procedures guided by these group documents. Applicable procedures include:

Document No.	Title
A2A-ALL-HSES-0007-P	PERSONAL PROTECTIVE EQUIPMENT
A2A-ALL-HSES-0008-P	REGULATORY COMPLIANCE
A2A-ALL-HSES-0009-P	PRE-STARTUP SAFETY REVIEWS (PSSR)
A2A-ALL-HSES-0010-P	ALATUS INCIDENT & ACCIDENT REPORTING PROCEDURE
A2A-ALL-HSES-0012-P	CRISIS MANAGEMENT CALL TWO PROCESS
A2A-ALL-HSES-0017-P	SERVICING ELECTRICAL EQUIPMENT
A2A-ALL-QUA-0010-P	MAINTENANCE MANAGEMENT
A2A-ALL-QUA-0011-P	ALATUS TRAINING
A2A-ALL-QUA-0013-P	INDUSTRIAL AUDIT
A2A-ALL-QUA-0017-P	ALATUS QUALIFICATION & COMPETENCIES
A2A-ALL-QUA-0019-P	ALATUS ON-THE-JOB TRAINING (OJT) PROCESS
A2A-ALL-QUA-0025-P	ALATUS DOCUMENT IMPLEMENTATION AND CONTROL
A2A-ALL-QUA-0032-P	ALATUS MANAGEMENT OF CHANGE
A2A-ALL-QUA-0037-P	EMERGENCY PROCUREMENT

Periodically, audits are performed by the Industrial Audit group to determine the effectiveness of Air Liquide's implementation of the Industrial Management System.

3. Project Safety

Identification of Safety Vulnerabilities (ISV)

Air Liquide has significant experience with the installation of standard and custom designed equipment to meet a variety of applications in many countries around the world. Hazard analysis is an important step in the design and installation of all equipment at Air Liquide. With hydrogen refueling stations both the equipment and the specific site must be evaluated. Air Liquide uses the same approach for hydrogen refueling stations used for other equipment installations.

Air Liquide uses a multi tiered approach in the Identification of Safety Vulnerabilities. All hydrogen projects are classified based on initial information provided for scope and location. Prior to formal design work a project risk assessment is performed to identify large issues related to the project, health & safety, reliability and the environment. During the project a full risk assessment is completed. The methodology is determined based on the type of project. For example a large installation would have a Hazard and Operability analysis (HAZOP) completed. A delivery trailer may use a Failure Modes, Effects and Criticality Analysis (FMECA.)

The risk assessment process at Air Liquide involves both a central team of safety experts and a local team of experts. The central safety experts completed a HAZOP and Accident Risk Analysis (ARA) for the C100 station design. The Air Liquide hydrogen station design process flow diagram (PFD) is globally consistent, therefore the HAZOP and ARA apply to all hydrogen installations. The proposed stations that use the same product model, the C100, would therefore apply this HAZOP and the ARA. The central safety team developed the HAZOP and ARA based on the equipment and commonly occurring site risks. Also the central safety group developed a quantitative risk assessment tool, called a Generic Risk Assessment (GRA) for the Hydrogen Supply Chain. The local team of experts uses the GRA to develop an Accident Risk Assessment (ARA) for each site.

Risk Reduction Plan

Air Liquide safety processes assess and manage risks through processes known as an Accident Risk Assessment for specific project designs (including the C100 and HyAC stations) and a Generic Risk Assessment which is applicable to all hydrogen installations. These are described below:

<u>Summary of the ARA for Hydrogen Stations</u> The Accident Risk Assessment for hydrogen stations used 8 nodes to identify 24 hazard scenarios called "feared events" in the evaluation:

> The most frequent 'feared event' is the ***development of a hydrogen enriched environment during the venting and purging process portion of gas delivery***. The analysis predicts the frequency for this event to occur once every 43.8 attempts (10^-1.64). Since every delivery requires the operator to vent and purge the connection prior to fuel transfer, this frequency is appropriate given the delivery frequency assumed in the analysis.
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> The initial system criticality for the venting and purging event is unacceptable. The risk associated with a hydrogen rich atmosphere is the risk of fire or explosion. The risk is reduced to an acceptable level when mitigations are applied. The mitigations for this feared event are the use of a vent stack complying NFPA 2 for design and installation. NFPA 2 references CGA G 5.5 Vent System Design, a commonly practiced design standard developed by CGA, the Compressed Gas Association. Air Liquide's own internal standard, GT-PR-PIP-005 provides further guidance for vent stack design and installation at Air Liquide facilities. Design of vent systems includes several requirements:
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> - conveyance of gas from release valves (purge or relief valves) without unacceptable restriction, prevent pressures to develop in the vent system and thus determines the size of the vent
> - Appropriate design of release point for gas from the vent system. Direction of flow and weather prediction is critical. Since hydrogen is extremely buoyant and diffuses quickly

in open air, the vent stack must direct the flow of release gas upwards. This upward release point must include some form of weather protection to prevent blockage from ice or other environmental conditions.

- Appropriate location of the release point at the facility. This includes both the height and physical location at the site. Hydrogen stations are particularly challenging as the site is intended for retail sale of fuel in a convenient location. Both CGA 5.5 and NFPA 2 provide guidance regarding location of the vent system.

The second most frequent 'feared event' is the ***rupture or leakage of the transfer hose between the customer vehicle and the customer connection point***. The analysis predicts a frequency of this feared event to occur every 192.8 hours (10^-2.28). Experience from the hydrogen community, including US, Japan and European stations, suggests hoses fail leak tests at a frequency of every 500 hours or 200 fills. In the case of automatic detection the station stops the fuel transfer, conducts a soft shutdown which includes reducing pressure in the piping between the high pressure storage and the dispenser, isolating the dispenser from high pressure storage and sends an automatically generated maintenance request to replace the hose. There are many failure modes associated with the transfer hose; however the most common occurring failure mode for the fueling hose leak is the failure of the hose material or hose to fitting connection. The risk is reduced through the following mitigations:

- Automatic leak checks - both immediately prior to each fueling and an automatic daily leak check which occurs when fueling is not anticipated (i.e. middle of the night). Automatic leak checks pressurize the dispensing system, including the hose, then isolate the dispensing system and monitor the pressure drop. The acceptable pressure decay varies from site to site due to the distance between the dispenser and the isolation valves as well as the ambient temperature. The automatic controller is pre-programmed to calculate an acceptable pressure drop under a variety of conditions.
- Hoses are replaced on a frequency of once every 500 fills or every 6 months whichever occurs first
- The hose leakage is an industry wide issue as the replacement frequency is unacceptable. New vendors, improved fabrication techniques and different materials are the subject of private and public partnerships as well as characterization testing at national laboratories such as NREL (YouTube video:
  https://www.youtube.com/watch?v=Rbc7f01oP8k and article:
  http://www.nrel.gov/docs/fy14osti/61091.pdf)

The next most common failure mode related to hose failure is vehicle drive-off, occurring approximately every 20,000 fuelings (10^-5.30) in forklift installations. Light duty vehicles don't yet have the demand frequency of the forklifts, however drive-offs are expected to occur with hydrogen at a frequency no greater than forklifts. Many light duty vehicles include a feature which disables the vehicle when the fuel door is opened, which is not a current feature on forklifts.

<u>Summary of the GRA for Hydrogen Supply Chain</u> The Hydrogen Supply Chain GRA (Generic Risk Assessment) outlines the feared events and predicted frequencies common to any Air Liquide hydrogen installation. The GRA applies common practices and company policy requirements to determine the

resulting risk for those common feared events. This system establishes a basis for site specific evaluation. Air Liquide's approach to GRA when completed becomes a standalone ARA (Accident Risk Analysis) for a specific location uses an analysis tool established by the central safety team which is then provided to qualified users in each region. The subsequent ARA performed for each site by the regional team is therefore a site specific version of the original GRA. Individuals qualified to perform the ARA are also responsible for providing feedback and corrections on the GRA to the central risk team. The GRA and ARA system including feedback is not unique to hydrogen stations within Air Liquide; this process is practiced for all product lines and all installations.

Operating Procedures

To achieve highest levels of safety and reliability, multiple resources must be deployed to respond to all station alarms. Air Liquide employs a multi-faceted system of managing equipment performance:

All system alarms are monitored by Air Liquide's 24 hour response desk in order to quickly access the cause of the alarm. The 24 hour desk receives equipment alarm signals, and customer or user complaints via their toll free number 1 800 323 1970. This is an existing service desk located in Houston, TX that allows Air Liquide to serve its 11,000+ customers across the US on a 24/7 basis. The 24 hour desk will be used to serve and respond to future H2 fueling systems requiring repair or intervention.

- The 24 hour desk has over 90 Field Service personnel available to respond 24 hours a day to equipment malfunction.
- Our field service personnel have the ability to monitor and troubleshoot remotely over a secured portal that is proprietary technology to Air Liquide, and resolve many minor issues without needing to be on site.
- A third party monitoring service will monitor for all system trouble, gas detection and fire alarms.
- All equipment maintenance is managed and logged in our IBM Maximo Computer Maintenance Management System (CMMS). This system allows us to maximize system uptime by tracking all predictive and preventative maintenance schedules and costs, and to maintain the correct level of spare parts on hand to speed up repairs.

Equipment and Mechanical Integrity

One component of the high safety standard Air Liquide employs in the design of our fueling stations is the designation of components that are defined as **Elements Important to Safety** (EIS). These safety elements include multiple gas and flame detectors, multiple emergency stop buttons, high-high and low-low pressure and temperature shut down devices and properly designed and installed relief valves which are piped to a safe location. All components designated as an EIS are subjected to additional testing, vendor qualification and auditing, documentation and preventative maintenance so we assure safe operation of our equipment.

The fueling process is monitored through a programmable logic controller (PLC) algorithm that records pressure and temperature in the dispenser and the vehicle fuel tank. The fill is stopped as soon as the pressure level reaches the equivalent of 700 bar at 15°C by using the process control which is based on vehicle tank temperature monitoring. As the fill ends, the filling hose is depressurized through to a vent valve to avoid the operator having to manipulate the hose under pressure.

The station recharge begins when the pressure in the buffer storage (either MP or HP) tubes reach a low set point (based on the fueling performance specifications). This in turn activates the compressor (either MP or HP) for refilling its respective buffer tubes until a high pressure set point on the buffer tube is reached. This procedure is automatic and controlled by the station PLC.

To ensure safety, a systematic leakage test is done before each fueling operation to check leak tightness of the dispenser and the connection between nozzle and receptacle. In addition, a daily leak test is done on the station to ensure the overall integrity of the installation when the station is in stand-by mode. The daily leak test is programmed to occur in the non-peak operating hours. Also, the pressure level is continuously monitored between the dispenser and hydrogen pad to check pipe integrity to avoid GH2 release. Other safety features related to the operation of the system include 24-hour monitoring of the hydrogen flame and leak detection systems and well as the overall process system.

Our station safety features include:

- User training on fueling procedure prior to each fill
- Leak testing prior to each fill to ensure connection integrity
- Hydrogen flame and leak detection with 24-hour monitoring by a third party service
- Daily comprehensive station leak tests
- Monthly maintenance checks by operations team
- A breakaway coupling on the fueling hose to ensure a mechanical interruption of the fuelling event in the case where the vehicle driver would drive away from the dispenser without removing the nozzle

A focus around hydrogen dispensing is important to the successful handling and distribution of compressed gaseous hydrogen. To achieve the standards and test methods set forth through CSA HGV 4.1, SAE J2601 and CSA HGV 4.3, we have incorporated some key features in our design to support the fueling process. Many of these features are integrated into the dispenser.

The fuel dispenser is certifiedand fueling process is compliant to SAE J2601. The dispenser is certified to CSA HGV 4.1, NFPA 2, NFPA 496 standards w/ break away, relief valve, process vent stack, manual shut off, flame and gas detection, hose break away and emergency stop button. The dispenser will perform a system leak test prior to each fill, and twice during each fill, as well as once per day. The dispenser will contain all the signage required by fire codes and the International Fuel Gas Code. In addition to being safe, the dispenser will also contain Point of Sale equipment matched to the current property owners system, creating a more familiar use experience for the consumer. The dispenser will contain all of the operational instructions needed to train the driver and will have an algorithm that will require all first time users to view the operational instructions.

Station equipment, particularly hydrogen compression equipment is certified to NFPA 2, CSA HGV 4.8 and CSA HGV 4.5.

Air Liquide's hydrogen filling stations employ a web based data logging system that collects the following data on a daily basis.

- Start time for each fill

- Duration of fill
- Initial temperature and pressure of vehicle tank
- Final tank temperature and pressure of vehicle tank
- Mass delivered
- Operational availability of equipment
- Gallons of gasoline and/or diesel fuel displaced
- Expected air emissions reduction
- Number of hydrogen fills per day per station
- Number of days per month hydrogen vehicles are fueled at the station
- Number of days per month the hydrogen station is operational
- Maximum capacity of the new fueling system (actual)
- Expected air emissions reduction

This data is presented in spreadsheet form and rolls up to monthly and yearly totals. This data will be collected and saved for the entire duration of the project.

Air Liquide's company-wide telemetry network will be used for tracking the proposed stations. This system allows 24-hour monitoring of equipment status and process variables as well as the ability to automatically store, analyze and distribute the above data variables.

Effective management of change is critical to maintaining a safe and reliable operation for the lifetime of the equipment. Management of change is accomplished differently in each phase of the product lifecycle. During design, change management is accomplished through design drawing changes by the project engineer. These changes are then reviewed by other competent engineers. The final design is validated additionally by a PHA attended by several subject matter expert engineers and at least one senior level engineer (Design Authority). Change management during commissioning is managed through redlined drawings approved by the design authority. The responsibility to implement the MOC process transfers to a facility manager once a facility is commissioned. Any employee may suggest a change, the facility manager then routes the change to an assessor who reviews the change request and determines the validity and any requirements needed to maintain safety during the change process. Assessors are competent engineers considered subject matter experts. aB&T maintains a list of assessors for management of change. If the change request involves an Element Important for Safety, a safety critical item such as a relief valve or a gas detector, the request must be first reviewed by the Industrial Risk Manager who determines if the change request must be reviewed and assessed by a Design Authority. All affected employees are trained on the Management of Change process which describes what constitutes a change (see below) and how to accomplish the change.

<u>Definition of a change</u>

- Physical changes and additions or deletions from existing systems and equipment including but not limited to, valves, piping, vessels, instrumentation, process control systems, safety systems, interlock systems and electrical systems.
- Adding, deleting, or changing the revision level of existing software on control system computers.
- Changes to installation, legal permits, hazard assessment, start-up, operating, shutdown testing, inspection, maintenance, cleaning and emergency procedures.
- Changes in process chemicals, catalysts outside of the operating parameters.

- Changes in manufacturing recipes or technologies.
- Changes in operating parameters or conditions that are outside specified limits defined in the operating procedures.
- Changes in feedstock characteristics outside of the operating parameters.

The following are not considered a change:

- Changes in operating parameters or conditions that are within specified limits defined in the operating procedures.
- Changes of management programs and policies that do not affect safety, reliability and/or quality procedures, i.e., assignment of pre-qualified personnel in a crew.
- Retest within the specified ranges.
- Replacement-in-kind.

4. Communications Plan

Training

Air Liquide provides multilevel custom training for each filling station. Included will be training for:

- Station owners
- First responders
- Operations and Maintenance personnel
- FCEV Drivers. The operation of the dispensers will be simple enough that a driver will be able to safely dispense without much more knowledge than the simple instructions posted on the dispenser. Air Liquide intends to include a training video at each dispenser to qualify drivers in the operation of the dispensers. In addition to this, Air Liquide will train the drivers of any large fleet that plans on utilizing the station.

Air Liquide utilizes numerous safety features and a combination of risk reducing layers of planning, risk assessment, monitoring, and backup plans based on our extensive experience with design, construction, and operation of vehicle fueling stations throughout the world to ensure high levels of safety, reliability, and availability of our stations.

Safety Reviews

Air Liquide utilizes a multi level approach to safety review cycles to ensure incidents are captured, investigated and corrective actions implemented, the equipment and installation are validated to ensure compliance to safety requirements and management is notified and aware of safety issues and incidents.

Monthly, Air Liquide reviews overall safety and key safety metrics. This information is then communicated to management and employees through a monthly Sequential Safety Meeting. Annually, the executive management will review the safety metrics and incidents for the current year in order to support the development of the following year's safety plane. Bi-annually each fueling station will have a full technical safety audit to ensure that existing safety barriers and systems are operational and maintained according to plans and to identify any additional gaps created by new and updated local or national codes and standards. This audit will be reviewed at the annual executive management safety meeting

Safety Events and Lessons Learned

Any time an incident occurs at an Air Liquide facility it is documented in an electronic safety management system, depending on the severity level of the incident, a full root cause investigation may be performed, e.g. hazardous material release, injury, activation of a site Element Important for Safety. Additionally a "Safety Flash" will be completed and distributed. These incidents are reviewed monthly in an Air Liquide HSE Leadership Team meeting in order to share the event with other business lines

Emergency Response

The team is dedicated to maintaining industry leading safety, system uptime and reliability. In order to achieve this, multiple resources must be deployed to respond to all station alarms. Air Liquide employs a multi-faceted system of managing equipment performance:

The first line of defense for safety is a robust design that minimizes the potential for serious incidents. Our Hydrogen Fueling Station utilizes multiple elements to achieve a design that exceeds the safety requirements of the current recognized standards. Flammable gas detectors, flame detectors, safety integrated functions for pressure and temperature, and multiple pressure safety relief valves all combined to make it extremely unlikely that an emergency condition would exist at the Hydrogen Fueling Station.

However, it is not possible to envision every failure event. Therefore, *Air Liquide*'s chemical emergency response guidelines establish the necessary requirements for responding to emergencies resulting from the release of hazardous material, during transportation, or at a the hydrogen fueling station. These guidelines include emergency procedures, personnel responsibilities, and emergency response team development and duties. Our goal is to protect the health and safety of the public and our employees in the event of an emergency.

When emergency situations arise either from the public or from Air Liquide employees performing work at the hydrogen fueling station the Air *Liquide* 24 hour emergency number (1-800-324-7814) is posted at the hydrogen fueling station and is used to activate the emergency response system. An operator will take information from the caller and implement our emergency response process. The appropriate Emergency Response Coordinator (ERC) or team assigned to the San Francisco Bay area will be notified immediately.

Two types of emergency response teams, primary and secondary, are located in various geographic areas to provide support in responding to hazardous material or related emergencies. Primary and secondary Emergency Response Teams (ERT) will respond to hazardous material emergencies, assess the situation, and take necessary action to control and minimize the hazard. Each ERT will consist of a Team Leader and volunteer staff who will receive specialized training. In addition, there is a network of trained responders, who can advise local personnel in an emergency when our E/R teams are not available.

ERT members are trained in accordance with the requirements outlined in OSHA 1910.120. This training includes initial training and annual refresher training on personal protective equipment, product hazards, specific emergency response actions, media communications, first aid and CPR procedures, etc. These ERT members will work with and support other emergency and first responders at the scene.

Additional Emergency response would be accomplished by local resources – we will engage the local authorities early in the permitting process to ensure that they are comfortable responding to a H2 emergency. We will provide training as needed so that the first responders understand the risks and the proper application of mitigation. Stations will be monitored so that in the event of an unplanned event local first responders will be notified.

Self-Audits

Self audits are integral part of any continuous improvement program and are explicitly defined in the Industrial management system employed at Air Liquide. aB&T hydrogen refuleing stations and hubs will be internally audited on a bi-annual schedule by qualified industrial auditors. Additionally, at least annually Facility managers (those in direct management control of the equipment) will perform a self audit defined in the Facility manager's annual HSE/Risk Management plan.

The audits will include at a minimum:

- Action items from previous audits,
- Validation of equipment design per drawing specification,
- Review of any previous incidents
- Compliance to relevant local codes and standards
- Compliance with Air Liquide Group Technical Standards