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HSE Program

May 2019

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Acknowledgment Form

Pieridae Energy Limited

Health, Safety and Environment (HSE) Program

May 2019

I have received the HSE Program and I am committed to reviewing its content in order to familiarize myself with the material presented.

Name: _____

Title: _____

Company: _____

Address: _____

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Signature

_____

Date

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Please acknowledge receipt of the HSE Program manual by signing this acknowledgement form. Retain one copy in the hard copy HSE Program manual for reference and return the other to:

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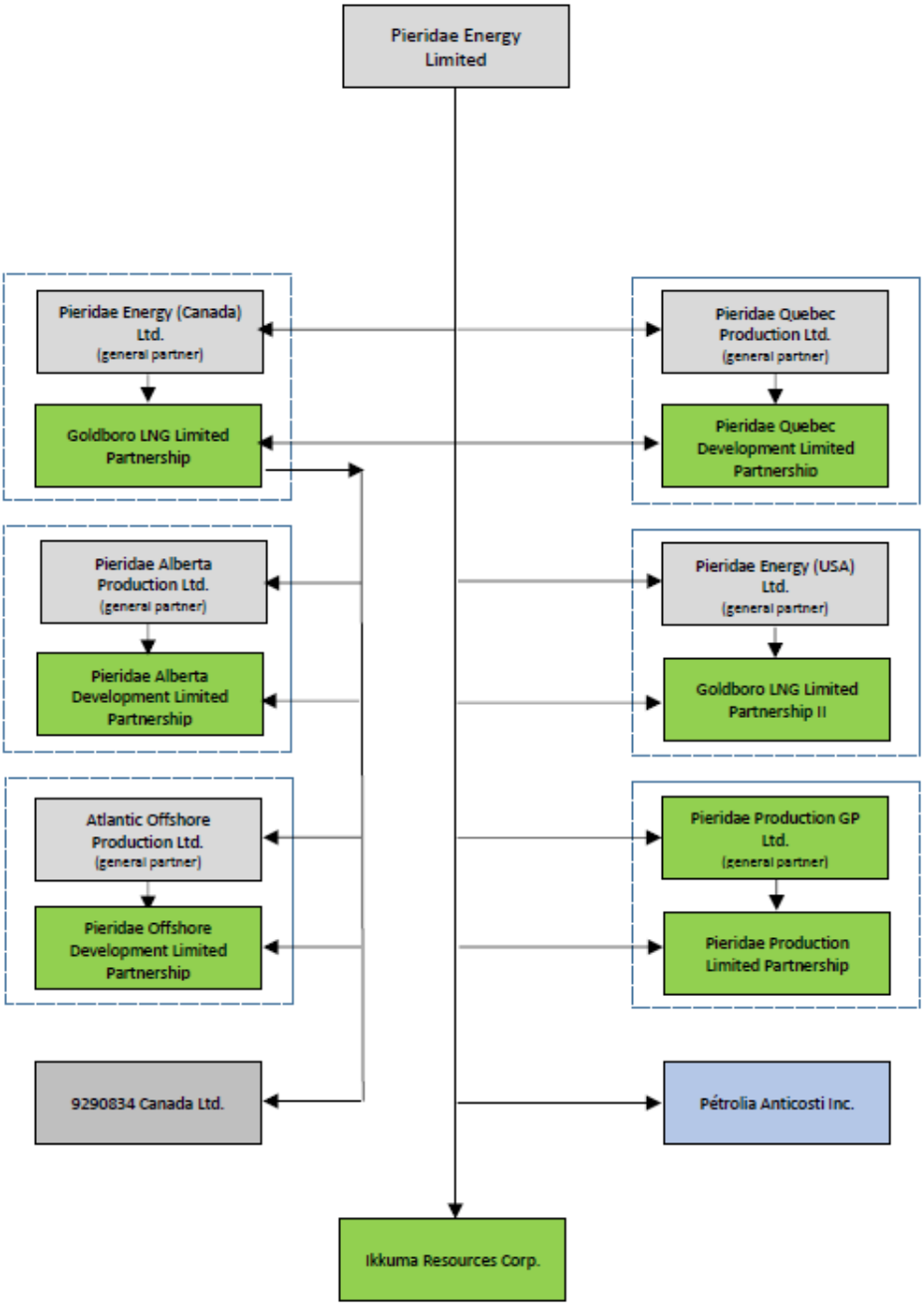
www.pieridaeenergy.com

Attention: Petra Struck, Sr. Engineering Technician
petra.struck@pieridaeenergy.com

Pieridae Energy Limited encourages and looks forward to your comments, suggestions and recommendations on the HSE Program. The HSE Program is a living document and can be updated and improved as operations, regulations or conditions change.

Pieridae Energy Overview of Operations

Founded in 2011, Pieridae, a majority Canadian owned corporation based in Calgary, is focused on the development of integrated energy-related activities, from the exploration and extraction of natural gas to the development, construction and operation of the Goldboro LNG facility and the production of LNG for sale to Europe and other markets. Pieridae is on the leading edge of the re-integration of the LNG value chain in North America.



An Introduction to Pieridae Energy's HSE Program

At Pieridae Energy, we take the health, safety and security of our employees, contractors, customers and neighbors very seriously. Pieridae's HSE management system is an organized and formal approach to managing HSE issues within the organization and is founded on the cycle of "plan – do – check - act" of continuous improvement. The Health, Safety and Environment (HSE) Program has been developed to guide Pieridae's operations. The HSE Program is intended to be used to assist workers to understand and meet regulatory HSE requirements and provides a structured approach, as well as consistent expectations, within the organization.

Pieridae encourages and looks forward to comments, suggestions and recommendations on the HSE Program. The HSE Program is a living document and can be updated and improved as operations, regulations or conditions change.

The HSE Program provides the umbrella guidance document for health, safety and environment but there are other manuals that provide specific information including: the Emergency Management Program (ERP) and Corporate Security Plan; Damage Prevention and Public Awareness Program, APEGA Professional Practice Management Plan; Quality Assurance (Pressure Equipment Integrity Management, Management of Change, Preventative Maintenance); and Pipeline Integrity Management, and other corporate governance and human resources policies and procedures, contributing to the overall safety and loss management system of the organization.

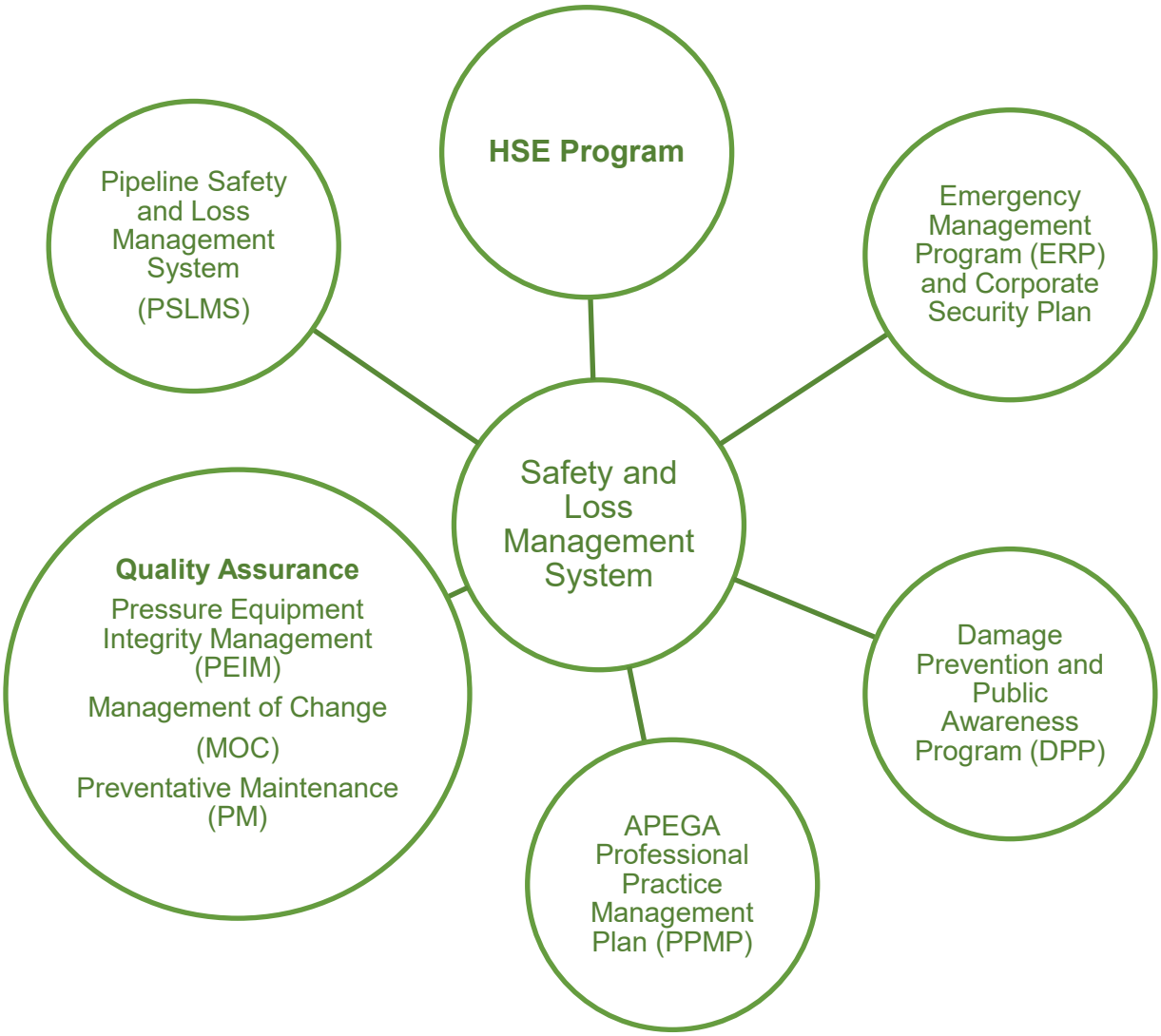
The HSE Program contains: a signed HSE policy (or corporate commitment) that provides the foundation; procedures that provide the framework for operations; and all associated forms. The HSE Program includes 13 components essential for an effective HSE Program including:

- HSE Policy
- HSE Responsibilities
- HSE Management System
- HSE Training
- Personal Protective Equipment
- Hazard Identification and Control
- Planned Inspections
- Contractor Safety
- Standard Operating Procedures
- Environmental Operating Procedures
- Corporate Emergency Response Plan (refer other manual);
- Incident Reporting and Investigation
- Drilling and Completions Guidelines

The HSE Program further promotes development of site specific procedures based on job hazard analysis. Site specific procedures provide additional operating instructions to the standard operating procedures and/or specific operating information not included in the HSE Program.

Safety and Loss Management System Overview

Designed to define and achieve performance and compliance.



Revision Log

Pieridae Energy
HSE Program

May 2019 Update

Instructions:

Hard copies – Replace all pages.

Electronic copies – The electronic copy of the document on the Ikkuma website is the most current, reference precedent document and should be used when transmitting the document electronically or when using shared drives.

Section	Hardcopy Replacement Instructions	Reason for Change	Description
Throughout	All	Name Change	Changed from Ikkuma Resources Corp and Ikkuma to Pieridae Energy Limited and Pieridae throughout. Added Calgary, Halifax and Quebec City offices and emergency phone numbers.
Introduction	All	Corporate Changes	Added overview of operations, corporate organization chart (company relationships), updated the introduction to the HSE Program, added an explanatory Safety and Loss Management System relationship chart.
Section 1.0 HSE Policy	All	HSE Policy	Updated – available in English & French.
Section 2.0 HSE Responsibilities	All	Responsibilities	Updated responsibilities for workers, work site supervisors, management and senior management, HSE representatives, moved safety ombudsman to this section, added organizational chart, updated HSEC members.
Section 3.0 HSE Management System	All	Updated references	Cross-referenced with ISO 45001 Occupational Health and Safety Management Systems. Throughout document updated language to “worker” and focused on worker right to know, right to participate and right to refuse dangerous work. Changed accessibility language throughout to documents being “readily available” to workers. Added new section 3.8 Management Review and Continuous Improvement, added 3.9 Measurement and Continuous Improvement including metrics and targets (KPIs) and leading and lagging indicators. Added section 3.10 Documents and Records (Document Control).
Section 4.0 Training	All	Updated	Added worker rights and competency language. Changed name of Optional Training to Additional Training. Added hazard identification and control and safety and HSEC meetings to orientation. Updated HSEC language to follow provincial HSEC language, and specified AB and BC requirements. Added 4.6.8 Emergency Response Team Training.
Section 5.0 PPE	All	Updated	Minor tweaks and addition of pictograms to PPE. Added more information to fall protection and added a new section 9.34 Working at Heights, added exposure language to 5.10 Respiratory Protective Equipment. Added a new section 5.12 Lifejackets and Personal Floatation Devices.
Section 6.0 Hazard Identification and Control	All	Updated	6.1 Added definitions for hazards and hazard assessment safety and health categories, updated right and obligation to refuse dangerous work, updated hazard communication, added new section 6.1.4 Hierarchy of Controls, added new section 6.1.5 Risk Assessment and provided and example 4x4 matrix, updated formal hazard assessment and development of standard operating procedures to include an annual formal hazard assessment and updated the list of standard operating procedures, updated JHA and development of site specific procedures including language that site specific procedures should be developed as required by other management systems for critical tasks). 6.2 Safe Work Permits – updated chemical exposure and SDS language (including Form 18 – Safe Work Permit). Specified the permit issuer is the Pieridae Rep. Added contractor FLHA requirements. Added record retention requirements. 6.6 Chemical Exposure/WHMIS – changed the name of this section from WHMIS to Chemical exposure, added exposure definitions, added a chemical inventory procedure, removed all references to WHMIS 1988 and only include WHMIS 2015 information (the transition period ceased January 1, 2019).

			Added clarification for training and how to access Pieridae's SDS. Added language that exposure limits must not exceed OELs and must be kept to as low as reasonably achievable. 6.7 TDG – clarified emergency reporting requirements.
Section 7.0 Planned Inspections	All	Updated	Add requirement for each operating area to establish and maintain an inspection program that is appropriate for the equipment and operations conducted in the operating area and that inspections will be completed as per the schedule and may include daily, weekly, monthly, quarterly, semi-annual and annual inspections. These inspections must be documented. Added more language to preventative maintenance including definitions. Added clarifying language to the HSE Assessment procedure. Added a new Section 7.7 Records.
Section 8.0 Contractor Safety	All	Updated	Added that a safety program that satisfies applicable provincial OHS legislation is required. Added that a safe work permit will be issued to contractors. Updated Form 04 – Contractor's HSE Orientation pamphlet. Pamphlet updates: changed name, changed red to green fonts, aligned introductory statement with new policy statement, added Pieridae website to learn more about the company and commitments, updated language to align with new Energy Safety Canada CSO, added the word cannabis to the alcohol and drugs policy statement, added contractor field level hazard assessments , added hierarchy of controls, added CSO pictograms to hazard section, reworded safety ombudsman section added requirement that contractor's must have a safety program that satisfies applicable provincial legislation.
Section 9.0 Standard Operating Procedures	All	Updated	Added: Added a descriptive sentence that standard operating procedures are based on an annual formal hazard assessment. 9.8.11 Bloodbore Pathogens 9.10 Fit for Work – Alcohol, Cannabis and Drug Policy and Procedure (added cannabis to header and referenced marijuana/cannabis, removed random drug testing) 9.12.5 Search and Notification – added more one call and ground disturbance information. 9.16 H_2S (added reporting requirements, added truck loading/unloading requirements to working in H2S Conditions greater than 10ppm) 9.18 Manual Lifting – added introduction and general considerations for manual lifting. 9.25 Safety Device Bypassing – added due to CSO reference in contractor orientation 9.26 Silica (Crystalline Silica) – added new hazard for stimulation 9.28 Security and Crime Prevention – referred to the Corporate Security Plan. 9.33 Working Alone: added 9.33.3 Field Production Operations Standardization requirements and 9.33.4 Travel and Journey Management – added new section to working alone for journey management in isolated and remote areas 9.34 Working at Heights – added more information to supplement Section 5.9 Fall Protection (cross-referenced) 9.35 Violence & Harassment Prevention – added expectations, clarified contents, added 9.35.3 Actions Workers Can Take – Prevention (added proactive actions to Violence & Harassment Prevention section).
Section 10.0 Environmental Operating Procedures			Added introductory sentence to refer to applicable provincial legislation. 10.4 Benzene Emissions – updated as per AER D039. 10.5 Flaring Venting and Incinerating and 10.6 Fugitive Emissions were merged into a new section 10.5 Vent Gas Limits and Fugitive Emissions Management (Alberta) to align with Alberta's new AER D060, D039 and Manual 16.
Section 11.0 Corporate ERP			Listed three current ERPs: Northern AB & BC Foothills ERP, Central AB Foothills ERP, Sierra/Ekwan BC ERP.
Section 12.0 Incident Reporting & Investigation	All	Updated	Added: Additional explanation regarding incident reporting types, definitions and examples and TRIF calculations. 12.3.5 Alberta – Electrical Incidents to reporting requirements. 12.6 Witness Accounts – provided guidance and a new Form 11d – Witness Statement.

			12.8 Root Cause Analysis – added information to enhance incident investigation, added definitions and referenced various models and added CCOHS language for MORT (Management Oversight and Risk Tree) for evaluating task, material, work environment, personnel, and management factors. 12.9 Trending and Analysis – added new section explaining trending, prevention and KPIs key metrics. Added requirement to calculate TRIF. Updated Form 11a – Incident Report to include “immediate corrective actions taken”, and Form 11b – Investigation report to included corrective actions.

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Section 1.0

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1.0 HEALTH, SAFETY AND ENVIRONMENT POLICY (ENGLISH)

PIERIDAE ENERGY

Health, Safety and Environmental Policy

Safety of our employees, communities and the environment is the top priority.

The Company takes the health, safety and security of our employees, contractors, customers and neighbours very seriously.

Our commitment to health, safety and environment is founded in our company values. These values are put into action every day. Our people are dedicated to making the Company an exemplary corporate citizen for our work force as well as local communities, First Nations and indigenous communities, regulators and government.

The Company is committed to achieving health, safety and environmental excellence throughout our entire organization by:

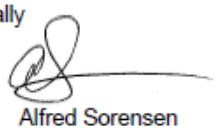
- Leadership and culture. We require a high level of commitment to health, safety and environment, not only from our management and employees, but also from our suppliers, contractors, visitors and guests. We will be leaders based on a culture founded on integrity and respect.
- Corporate management. Management is focused on ensuring that health, safety and environment is our highest priority. Such management focus helps ensure that we comply with or exceed regulatory requirements. If operational results and safety ever come into conflict, our employees and contractors have a responsibility to choose safety and management will support this choice.
- Community communication and stewardship. Corporate sustainability and responsibility activities will be collaborative, reward-based, performance-driven, integrated, diversified, and scalable.

We have a responsibility toward people and the environment. We expect it, and our investors and stakeholders expect it. This commitment will ensure the long-term success of the Company.

Commitment

Our commitment is to work continuously toward excellence through a process of "plan, do, check, act" by:

- designing and maintaining hazard-free offices and operations
- implementing effective and responsible work processes and procedures based on applicable standards, regulations, industry best practices, and manufacturer's specifications
- ensuring all personnel are trained and competent, and have the necessary tools to work safely
- supporting hazard, near miss and incident reporting and investigation, and ensuring corrective actions are taken
- responding promptly and effectively to emergencies in order to minimize the consequences
- procuring sustainable materials, recycling or reusing materials when possible
- conserving and being a responsible steward of natural resources
- continuously improve health, safety and environment efforts by regularly reviewing program effectiveness
- reporting results internally and externally



Alfred Sorensen
Chief Executive Officer

HEALTH, SAFETY AND ENVIRONMENT POLICY (FRENCH)

PIERIDAE ENERGY

POLITIQUE SANTÉ, SÉCURITÉ ET ENVIRONNEMENT

La sécurité de nos employés, des communautés et de l'environnement est notre priorité.

Notre entreprise prend la santé et la sûreté de nos employés, sous-traitants, clients et voisins très sérieusement.

Notre engagement envers la santé, la sécurité et l'environnement est fondé sur les valeurs de notre entreprise. Ces valeurs sont mises en œuvre tous les jours. Notre personnel est déterminé à faire de notre entreprise un citoyen corporatif exemplaire autant pour nos employés qu'envers les communautés locales, les Premières Nations et les communautés autochtones, les législateurs et le gouvernement.

L'entreprise s'est engagée à atteindre l'excellence en matière de santé, de sécurité et d'environnement dans l'ensemble de son organisation par:

- Son leadership et sa culture. Nous exigeons un engagement fort en matière de santé, de sécurité et d'environnement, non seulement de la part de notre direction et de nos employés, mais également de nos fournisseurs, entrepreneurs, visiteurs et invités. Nous serons des leaders en nous basant sur une culture fondée sur l'intégrité et le respect.
- Sa gestion d'entreprise. La direction veille à ce que la santé, la sécurité et l'environnement soient notre priorité absolue. Cette orientation nous permet de nous conformer ou de dépasser les exigences réglementaires. Si l'atteinte des résultats opérationnels et le maintien de la sécurité devaient être en conflit, avec le soutien de la direction, nos employés et nos sous-traitants ont la responsabilité d'opter pour la sécurité.
- Sa communication et son intendance envers la communauté. Les activités de l'entreprise seront axées sur le développement durable, la collaboration, basée sur la récompense et axée sur la performance, intégrées et diversifiées, tout en demeurant évolutives.

Nous avons une responsabilité envers la population et envers l'environnement. Nous nous y attendons et nos investisseurs et parties prenantes s'y attendent également. Cet engagement assurera le succès de l'entreprise à long terme.

Engagement

Notre engagement est de continuellement travailler à l'atteinte de l'excellence en déployant un processus de «planification, réalisation, vérification, d'action» en:

- Concevant et en maintenant des bureaux et des opérations sans risque
- Mettant en œuvre des processus et des procédures de travail efficaces et responsables fondés sur les normes, les réglementations, sur meilleures pratiques de l'industrie et se conformant aux spécifications des fabricants
- S'assurant que tout le personnel est formé, compétent et dispose des outils nécessaires pour travailler en toute sécurité
- Soutenant les rapports et les enquêtes sur les accidents, les quasi-accidents et les quasi-incidents et veiller à ce que des mesures correctives soient prises
- Réagissant rapidement et efficacement aux situations d'urgence afin d'en minimiser les conséquences
- Achetant des matériaux durables, en recyclant ou en réutilisant les matériaux, lorsque possible
- Conservant et en étant un gestionnaire responsable des ressources naturelles
- Améliorant continuellement les efforts déployés en matière de santé, de sécurité et d'environnement en examinant régulièrement l'efficacité du programme
- Rapportant les résultats tant à l'interne qu'à l'externe

Alfred Sorensen
Président Directeur Général

Section 2.0

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2.0 HSE RESPONSIBILITIES

2.1 Introduction

HSE is the joint responsibility of management and workers. To fulfill responsibilities, individuals must:

- Know what their responsibilities are;
- Have sufficient authority to carry them out; and
- Have the required ability and competence.

Once these criteria have been met, HSE performance can be assessed in an equal manner with other key job elements. HSE is not just an extra part of the job; it is an integral, full-time component of each individual's responsibilities.

2.2 General Rules

Every work site must have a prime contractor if there are two or more employers involved in work at the work site at the same time. The prime contractor for a work site is:

- The contractor, employer or other person who enters into an agreement with the owner of the work site to be the prime contractor, or
- If no agreement has been made or if no arrangement is in force, Pieridae (as the owner of the work site) is the prime contractor.

The following rules apply on Pieridae work sites:

General

- Employees are expected to conduct their affairs off the job in such a manner that they report for work each day in a condition that enables them to conduct their work safely;
- Horseplay, fighting, or other disturbances are strictly forbidden;
- Management and workers will not ignore safety responsibilities or issues and will take steps to address safety issues;
- The work site supervisor and all operating personnel at each work site are responsible for the implementation and enforcement of the HSE policy and procedures; and
- Firearms, weapons and explosives are strictly forbidden on Pieridae work sites. No employee or contractor will be allowed on a work site with these materials in their possession.

Drugs and Alcohol

- Illegal drugs (which under law are considered to be illegal) are not permitted on the work site or in camps;
- No worker (company or contractor) shall enter or be permitted to remain on a work site while under the influence of drugs or alcohol and will be discharged immediately;
- Workers taking prescription drugs that can cause drowsiness or affect work efficiency must inform their work site supervisor; and
- Pieridae will not tolerate any employee driving any vehicle (including Company owned, leased or rented vehicles) while conducting Company business while under the

influence of drugs or alcohol. Vehicles must always be driven in a safe and courteous manner.

Smoking

- Each field location should have an area designated as a smoking area. If there are questions, contact the work site supervisor.
- Strike anywhere matches, or open mechanism lighters are not to be carried while working outside of the designated smoking areas.
- Smoking is not permitted within 25 meters of a well, separator, oil storage tanks or other source of ignitable vapor.

Facial Hair

- All employees and contractors who may have the potential need to wear respiratory protective equipment shall adhere to the facial hair policy. Facial hair is defined as beard, moustache, side burns, low hair line, bangs and/or stubble growth.
- Any facial hair that may interfere with the proper sealing of respiratory equipment is to be removed unless fit testing has been completed. Employees shall not have facial hair that passes between the sealing surface of a respirator face piece and their face, and they shall not have facial hair that interferes with the functioning of the respirator valves.
- Office employees and casual visitors are exempt from the facial hair policy if during their visit they are accompanied at all times by a local company representative and are not required to wear respiratory equipment.
- Long hair that may become entangled in moving machinery or equipment, or that may interfere with the proper sealing of respiratory equipment must either be tied back or cut.

2.3 Work Site Visitors

Field work site visitors must report to the work site supervisor. Visitors to office locations must check in with the reception and/or the person they are meeting. Responsibilities include:

- Check in and out;
- Report to the Pieridae work site supervisor;
- At field work sites, visitors must be escorted;
- Follow the instructions of the work site supervisor or escort; and
- Wear personal protective equipment as required.

2.4 Contractors

A contractor is an external organization providing services to the organization.

Refer to Section 8.5 Contractor Responsibilities.

2.5 Workers

A worker means a person engaged in an occupation. A worker is a person performing work or work-related activities under the control of the organization. Everyone is a "worker" first. Responsibilities include:

- Take reasonable precautions to protect yourself and other persons at or in the vicinity of the work.
- Cooperate with work site supervisors.
- Comply OHS acts, regulations and codes as may be applicable.
- Refrain from causing or participating in harassment or violence.
- Become thoroughly familiar with the HSE Program.
- Actively participate in HSE Program development and maintenance.
- Follow safe work procedures.
- Use personal protection and safety equipment as required.
- Know and comply with regulations and Pieridae standards.
- Report incidents and accidents (including injuries or illnesses) immediately.
- Report unsafe acts and conditions.
- Report potential hazards to supervisors.
- Check tools and equipment, including personal protective and safety equipment, before using.
- Report any unsafe equipment to the work site supervisor.
- Be familiar with the location, type and operation of emergency equipment.
- Refuse to perform work when unsafe conditions exist (as defined in provincial occupational health and safety legislation).
- Participate in all training offered by Pieridae, either on or off the work site.
- Participate in safety meetings and review documentation that is provided to communicate HSE issues.

2.6 Work Site Supervisors

A supervisor means a person who has charge of a work site or authority over a worker. A work site supervisor supervises workers. Responsibilities include:

- As far as it is reasonably practicable for the supervisor to do so:
    - Be competent to supervise workers.
    - Take precautions necessary to protect the health and safety of workers.
    - Ensure workers follow HSE regulations and Pieridae HSE policy and procedures.
    - Ensure workers use hazard controls and PPE.
    - Ensure that workers are not subjected to or participate in harassment or

violence at the work site.

- Actively participate in HSE Program development and maintenance.
- Promote HSE awareness. Advise workers of known or reasonably foreseeable hazards.
- Instruct workers and contractors to follow safe work procedures.
- Enforce HSE regulations and Pieridae HSE policy and procedures.
- Correct unsafe acts and conditions.
- Inspect work areas and take remedial action to minimize or eliminate hazards.
- Ensure equipment is properly maintained.
- Ensure that only authorized, adequately trained workers operate equipment.
- Report and investigate all incidents.
- Report hazards and incidents and conduct investigations to resolve issues.

2.7 Management and Senior Management

For the intent of this manual: management supervises work site supervisors, and senior management supervises management. Management allocates overall responsibility, accountability and authority for the development, implementation and performance of the HSE management system and the achievement of the HSE objectives. Responsibilities include:

- Provide a safe and healthy workplace.
- Establish and maintain an HSE program.
- Ensure workers are aware of their HSE responsibilities and carry out safety related duties.
- Ensure that workers engaged in work are aware of their responsibilities and duties under the act, regulations and codes.
- Provide worker HSE training, as required.
- Encourage employee involvement in HSE by demonstrating management's commitment.
- Provide workers with HSE information and keep workers well-informed of new and updated regulations.
- Ensure all critical workplace documents (such as reports, plans and procedures) are in writing and available to workers.
- Provide adequate supervision at work sites.
- Ensure operations comply with government regulations.
- Provide appropriate, well-maintained safety and other equipment for each work site.
- Provide personal protective equipment.
- Support incident and hazard/near miss reporting and investigations and ensure corrective actions are taken; that person(s) reporting will be granted immunity from disciplinary action.

- Report incidents and cases of occupational disease to appropriate authorities, as required.
- Support supervisors in their HSE responsibilities.
- Evaluate HSE performance of supervisors.
- Tour work sites to observe work practices and talk to workers about HSE. The frequency of tours will vary according to the type of operation. Generally, managers should tour work sites at least once every six months and supervisors should tour work sites at least once every three months (quarterly).

2.8 HSE Representatives

Persons with specific responsibilities, accountability and authority for health, safety and environmental activities within the organization. Responsibilities include:

- Advise workers on HSE matters.
- Coordinate and advise regarding HSE training.
- Conduct and research special problems or new and changing regulations.
- Ensure HSE program is current.
- Attend HSE meetings as a resource person.
- Provide a regular HSE Report that summarizes.key HSE issues.
- Collect and analyze HSE statistics.

2.9 Safety Ombudsman

Safety concerns must be addressed and must not be ignored under any circumstances. If anyone on site is not satisfied with safety performance or has safety concerns that cannot be satisfactorily addressed on site they must feel free to contact the safety ombudsman without fear of reprimand.

The safety ombudsman is the Senior VP, Engineering.

2.10 Organization Chart

In addition to the overarching corporate structure provided in the executive summary of this manual, a personnel organization chart should be prepared and updated regularly (i.e. as structure or operations change).

With respect to health and safety responsibilities (as described earlier in this section), there are four levels of accountability and responsibility, regardless of title:

- Worker – everyone is a worker. (With respect to safety, everyone is a worker first, then additional responsibilities are added.)
- Supervisor – supervise workers.
- Management – supervise supervisors.
- Senior management – supervise management.

There are OHS regulatory definitions for workers, supervisors, contractors, prime

contractor, employer, joint health and safety committee and/or health and safety representative etc. Refer to regulatory definitions as appropriate.

2.11 Health, Safety and Environment Committee/Joint Health and Safety Committee

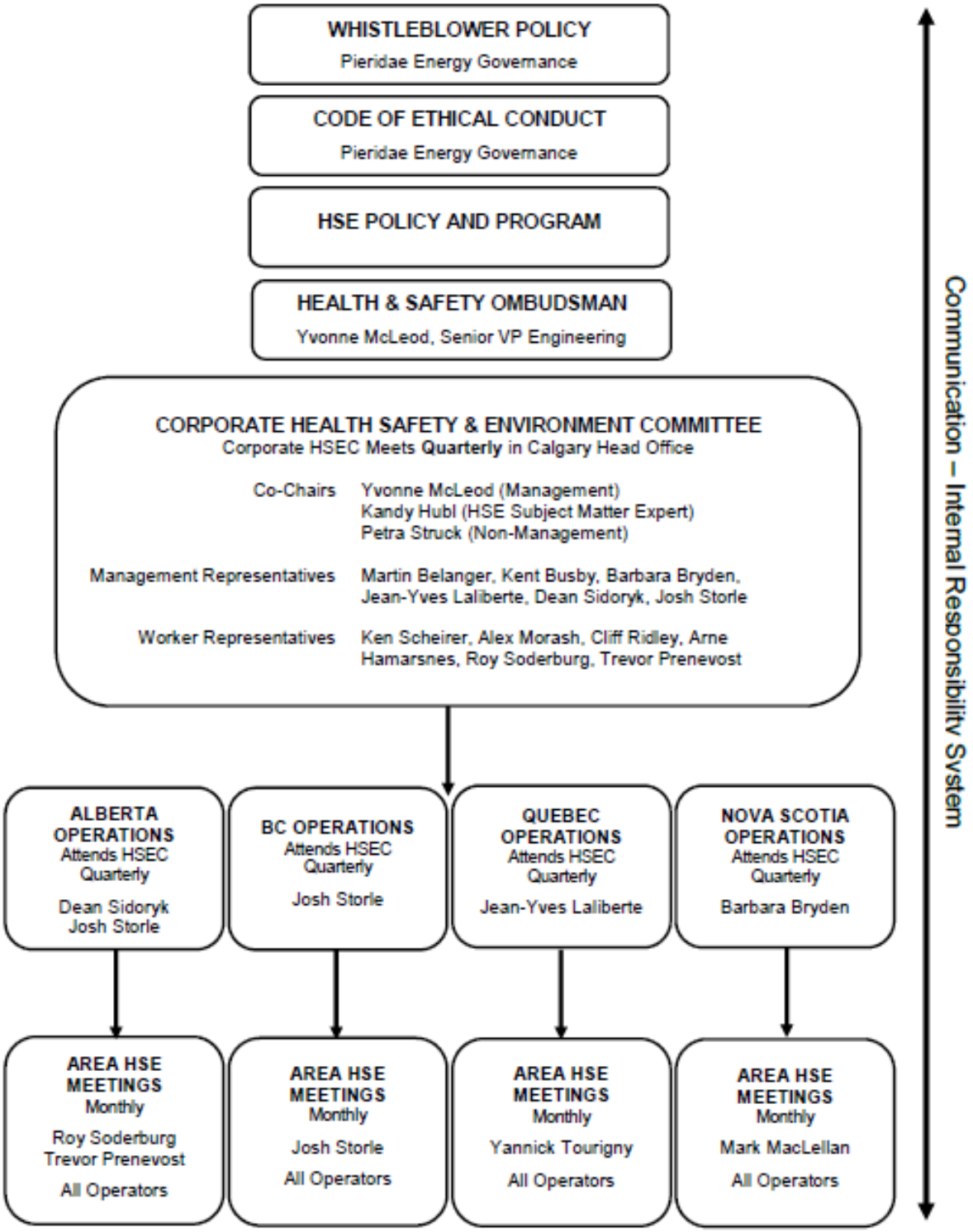
Provincial requirements with respect to joint health and safety committees will be followed. A joint health and safety committee will be formally established if a workplace has 20 or more workers. In smaller workplaces (more than 9 but fewer than 20), a worker health and safety representative may be adequate. Please note that in BC HSC meetings are typically held monthly, whereas in Alberta Pieridae has elected to conduct quarterly HSC meetings.

Together with Pieridae's well established regularly scheduled safety meetings, an additional and complimentary quarterly HSEC meeting will be held in the Calgary office. Pieridae has an integrated health, safety and environment management system and well-established reporting procedure. The responsibilities of the HSC are:

- Review the available monthly HSE Reports and keep abreast of new regulatory requirements that may impact policy and procedures.
- Consult on broader health and safety issues.
- Address health and safety complaints from workers.
- Participate in identifying unsafe situations or practices and advise on solutions.
- Make recommendations around health and safety improvements and educational programs, and monitor the effectiveness of those programs.
- Advise on programs and policies required under the OHS Regulation and monitor their effectiveness.
- Advise on proposed changes to the workplace (e.g., machinery or equipment) or work procedures that may affect the health and safety of workers.
- Ensure that incident investigations and regular workplace inspections are carried out as required by OHS regulations.

To facilitate this process members of the joint health and safety committees will be trained; meetings will be documented and the monthly HSE Report will be used as a guide to facilitate discussions.

HSC Structure and Meeting Frequency



Section 3.0

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3.0 HSE MANAGEMENT SYSTEM

3.1 Introduction

A management system is a set of interrelated or interacting elements of an organization to establish polices, objectives, and processes to achieve those objectives. It is generally recognized that HSE issues are often similar and more often overlap. The systems and processes to achieve HSE objectives are also similar. It is for this reason that Pieridae has developed a fully integrated HSE management system.

Pieridae's HSE management system is an organized and formal approach to managing HSE issues within the organization and is founded on the continuous improvement cycle of, "plan, do, check, act." Pieridae's HSE Program is intended to be used to assist Pieridae employees to understand and meet regulatory HSE requirements. The HSE Program is a reference tool and should be used as such. Pieridae will manage HSE responsibilities by:

- Setting health, safety and environment policy. Policy defines, in a broad sense, what the Company wants to achieve and establishes HSE commitments. Policy is the intention and direction of the organization as expressed by senior management.
- Planning to ensure success of the policy. Planning provides the framework for establishing HSE goals and objectives, developing strategies for achievement and allocating resources to implement strategies. Planning establishes overall direction.
- Implementing programs and procedures. Implementation provides structure and delineates the roles, responsibilities, authority, and accountability for accomplishing the work.
- Monitoring and measuring to evaluate performance. Monitoring provides a mechanism to track and evaluate progress towards achievement of established objectives and targets.
- Checking for and correcting identified issues. Checking keeps the company on track relative to goals and objectives.
- Periodically reviewing the entire system. Reviews ensure that the system continues to reflect and achieve goals and objectives over the long term.

The HSE Program is a policy and procedure manual that reflects Pieridae's HSE supporting principles and it is the responsibility of all employees directly involved with field operations to be familiar with the program. In general, the HSE Program is structured as follows:

- The corporate commitment statement provides the overall HSE Policy and confirms Pieridae's commitment to HSE. The corporate commitment provides a foundation for the 13 basic program components;
- Standard operating procedures are described in the HSE Program and provide a framework for conducting specified activities (jobs); and
- Site specific procedures are not included in the HSE Program but they are an integral part of the overall implementation of the program. Site specific procedures prescribe applications relevant to a particular operating area or work site.

3.2 HSE Supporting Principles

The supporting principles of Pieridae's HSE management system are as follows:

- Seek opportunities to achieve continuous improvement in health, safety and environmental performance;
- Adhere to all applicable safety, health and environmental laws, regulations, industry codes of practice and Pieridae's standards to minimize risk to employees, the public and the environment;
- Recognize and respond to the public's concerns when examining risk;
- Promote and endeavor to do business with companies and contractors which share the same commitment to health, safety and environmental performance;
- Believe that with the right attitude and behavior, a zero accident objective is achievable;
- Support applied research to further knowledge, assist decision-making, and develop solutions to industry issues;
- Support our employees and contractors' responsibilities with respect to health, safety and environmental issues;
- Believe each employee is responsible to work safely and in a manner that protects co-workers, assets, the environment and the communities in which we operate; and
- Believe safe working conditions and environmental protection is equally as important as quality and productivity in measuring our business performance.
- Exercise due diligence. Due diligence is the level of judgment, care, prudence, determination and activity that a person would reasonably be expected to do under particular circumstances.

3.3 HSE Program Components

Pieridae's HSE Program has 13 basic components:

- HSE Policy;
- HSE Responsibilities;
- HSE Management System;
- Training;
- Personal Protective Equipment (PPE);
- Hazard Identification and Control;
- Planned Inspections;
- Contractor Safety;
- Standard Operating Procedures;
- Environmental Operating Procedures;
- Corporate Emergency Response Plan (Refer to other manual);
- Incident Reporting and Investigation; and
- Drilling and Completions Guidelines.

Pieridae's HSE Program is based upon the following generally accepted industry standard protocols:

- Basic Safety Program (Upstream Petroleum Industry Task Force on Safety);
- Basic Environmental Program (Canadian Association of Petroleum Producers);
- WorkSafeBC Occupational Health and Safety Regulation, Occupational Health and Safety Programs;
- Partnerships in Health and Safety Audit Instrument; and
- ISO 14001 Environmental Management Systems, ISO 45001 Occupational Health and Safety Management Systems, and the International Labour Office ILO-OSH 2001 Guidelines on Occupational Safety and Health Management Systems.

Further, Pieridae's HSE Program is based on applicable legislation and regulations including:

- Federal and Provincial Occupational Health and Safety Acts, Regulations and Codes;
- Provincial Energy, Mines and Resources Acts and Regulations and/or Rules;
- Provincial Workers' Compensation Acts and Regulations and/or Rules;
- Provincial Environmental Acts and Regulations including Water Act and Codes of Practice;
- Workplace Hazardous Materials Information Systems Legislation;
- Transportation of Dangerous Goods Legislation;
- Provincial Boiler and Pressure Vessels Acts;
- Building Code of Canada;
- Canadian Electrical Code;
- Alberta Environmental Protection and Enhancement Act;
- Oil and Gas Conservation Acts and Regulations; and
- Canadian Standards Association standards (i.e. CSA Z662).

3.4 Employee Input / Worker Participation

An integral part of the HSE management system is worker participation and input (i.e. involvement in decision-making). Worker participation is critical to the success of the program for the following reasons:

- The opportunity to provide input will encourage workers to support the "made for Pieridae" HSE Program;
- Workers offer valuable insight because of their skills, knowledge and hands-on experience with the work; and
- Worker support is necessary because the workers will be most greatly affected by the HSE Program.

Pieridae will ensure that workers are consulted, informed and trained and have the time and resources to actively participate. This is primarily achieved through the establishment and efficient function of the Health, Safety and Environment Committee (HSEC) structure throughout the organization. Refer to Section 2.11 Health, Safety and Environment Committee/Joint Health and Safety Committee.

3.5 Enforcement

Government HSE regulations represent minimum requirements. Pieridae has developed the HSE Program to augment regulations with specific procedures.

Pieridae is committed to managing company business, in all jurisdictions, through the use of effective HSE procedures that promote and maintain safe and healthy workplaces and protect all employees, contract workers, the environment and the public. Procedures are developed based on the following guidelines:

- Procedures will be specific to the HSE concerns in the workplace;
- Procedures will be stated in clearly understandable terms;
- Procedures will be stated in positive terms and will be explained;
- Procedures must be enforceable, since disregard for one rule may lead to disregard for others;
- Procedures will be available in written form; and
- Procedures will be periodically reviewed to evaluate effectiveness and to make changes for improved effectiveness.

Compliance with HSE Program is a condition of employment. The HSE Program will be distributed to new employees directly involved with field operations and explained during the orientation. Refer to Section 4.2 Orientation.

HSE considerations are also an important component of contractor selection. Refer to Section 8.3 Contractor Evaluation.

Supervisors are responsible for correcting unsafe acts, such as breach of rules, and are supported by management in this duty.

The following will be considered by supervisors when considering enforcement actions:

- Ensure the employees are aware of the regulation or procedure;
- Ensure that employees are not encouraged, coerced, or forced to disregard the rule by fellow employees or supervisors;
- Ensure all rules are observed;
- Ensure no violation is disregarded;
- The role of “discipline” is that of education, not punishment;
- Action is taken promptly;

- While having guidelines for penalties for the first offence or infraction may be desirable, some flexibility is required when applying the guidelines since each case will vary in its circumstances; and
- Action is taken in private and is recorded.

Note: Under provincial OHS legislation, OHS officers have various compliance and enforcement tools including stop work orders and administrative ticketing. Workers must immediately report any infraction to the work site supervisor. The work site supervisor is responsible to report the infraction via the incident reporting procedure.

3.6 HSE Program Administration

It is the responsibility of the designated Sr. Engineering Technician (HSE Coordinator) and Senior VP Engineering, in consultation with employees and support from senior management, to coordinate the preparation, implementation and maintenance of the HSE Program. HSE contractors can be used provide HSE training and support. The following points will guide the administration of the HSE Program:

- The HSE Program will be contained in a binder that is clearly labeled, easy to use, readily available and includes a table of contents. Hard copies are controlled.
- The HSE Program will be available electronically (soft copy) at www.blueskysolutions.ca and on the Pieridae website at www.ikkumarescorp.com (Corporate Responsibility) including the complete program and associated Appendix 1 – Forms.
- The intent of the HSE Program is to outline various procedures that are to be used as a guide to establishing and maintaining a safe work site. The HSE Program procedures are based in part on regulatory requirements and accepted industry practices, but are not intended to be used in substitution of those requirements.
- Employee input is integral to the HSE Program. The opportunity for employees to provide input encourages support of the HSE Program. Employees offer valuable insight because of their skills and hands-on experience with the work. Employee support is necessary because employees will be most greatly affected by the HSE Program.
- Every employee directly involved with operations will receive and become familiar with the HSE Program. The Acknowledgment forms must be signed upon receipt of the HSE Program and tracked by administrative staff to ensure updates are distributed appropriately.
- The HSE Program is a “living document.” As regulations, industry standards or Pieridae operations change the HSE Program will be revised and updated. As a minimum the HSE Program will be updated every three years. Employees are encouraged to submit (verbally or in writing) improvements or changes to the HSE Program that will more accurately reflect work site conditions.
- The date (month and year) will be shown in the footer of each component. Revisions will be sent out with a Revision Log that summarizes the changes and provides insertion requirements. Outdated sections/materials will be disposed of as soon as updates are received.
- An up-to-date list of employees directly involved with field operations and full-time

contractors (contract operators or other) will be maintained in the Calgary Office and either a controlled hardcopy or electronic copy (access) will be provided. The list will be used to distribute revisions.

- Copies of applicable HSE legislation and regulations will be readily accessible (i.e. through the internet).
- Specific oil and gas regulations will be readily accessible (i.e. through the internet).

3.7 Communication Methods

Effective communication is an instrumental component of the HSE Program. Pieridae management will regularly communicate to employees, the Board of Directors and to outside stakeholders, as deemed appropriate, Pieridae's commitment to HSE issues. Management will promote a high level of HSE excellence, provide the resource materials and training necessary to facilitate this standard and lead by example. The delegation of responsibilities will outline requirements and further facilitate implementation.

Pieridae employees and work site supervisors will utilize and reference the HSE Program components and will follow safe work procedures thereby promoting a safe and healthy workplace.

The more employees and contractors know about Pieridae's HSE Program, the better able they will be to support it. Standard operating procedures and in particular, the safe work permitting procedure, will incorporate HSE issues as a part of day to day business. Effective communication will result in greater participation of employees and contractors in the use, implementation and continued improvement of the HSE Program leading to higher morale and improved safety and environmental performance.

3.7.1 Availability of Information

Pieridae will make HSE information readily available including:

- Provincial acts, regulations or codes (e.g. via the internet or electronically stored).
- The HSE Program manual (e.g. via the internet, electronically stored, or in hardcopy).
- Information about hazards, hazard controls and work practices via this HSE Program manual and other related documents.

3.7.2 Informal Work Site Tours and Leadership

Managers and supervisors ("management") should tour work sites to observe work practices and talk to workers about HSE. The frequency of tours will vary according to the type of operation. Generally, managers should tour work sites at least once every six months and supervisors should tour work sites at least once every three months (quarterly). To communicate commitment to HSE, management can do any or all of the following:

- Tour work sites to observe operations and encourage discussions on HSE;
- Promptly respond to HSE issues that may arise;
- Provide feedback to employees on HSE performance, concerns and incidents;
- Participate in committees and meetings dealing with HSE;
- Include HSE topics as regular agenda items in meetings;
- Highlight HSE at Company functions;
- Provide detailed job instruction for new, transferred or temporarily assigned personnel;
- Ensure regular safety meetings are conducted and attend when appropriate;
- Recognize workers who work safely with consideration for HSE issues; and
- Support enforcement of the HSE Program.

3.7.3 HSE Report

An HSE Report will be prepared and distributed to Pieridae operations staff via email on a monthly basis. The HSE Report highlights:

- HSE Program administration;
- Current health issues;
- Current safety issues including incident reports, year to date incident statistics, documentation of safety meetings, industry safety alerts;
- Current environmental issues, including spills/releases, year to date spill statistics, environmental projects; and
- Regulatory issues, including: liability management rating, enforcement status, inspection results and new regulations.

3.7.4 Other Communication Methods

Various methods can and should be used to regularly communicate HSE issues as follows:

- “Open-door policy” - employees should communicate directly to their immediate supervisor to discuss HSE related issues. Pieridae will maintain an open, honest and trusting culture that will promote communication between employees and management.
- Weekly and/or daily operations reports - field reports specific to drilling, production or workovers can also include information on HSE issues. Regular verbal communication provides a further opportunity to discuss and address HSE issues.
- Work site supervisor HSE packages – Project consultants (construction, drilling, completion and pipeline/facility supervisors) will receive a customized HSE package at the beginning of a new project. Consultants that regularly work for Pieridae may keep the various HSE materials but completed forms pertaining to a project must be sent to Pieridae for review and file. The packages are designed to facilitate implementation of the HSE Program by consultants that work for Pieridae in the capacity of work site supervisor. The

package includes Pieridae's HSE Program, instructions on use of relevant procedures and forms, emergency contact information and training requirements.

- Incident reports - incident reports communicate the situation and investigation reports communicate the causes and remedial actions.
- HSE inspections – monthly checks as part of the preventative maintenance program and annual HSE assessments help to communicate to the operations team the efficacy of the HSE Program and compliance to regulations and corporate procedures.

3.8 Management Review and Continuous Improvement

Pieridae management will regularly assess implementation and compliance with the HSE Program in order to ensure the system is working effectively, to identify areas for improvement, and to improve overall HSE performance.

- Weekly Management Meeting – weekly management meetings include health and safety incident reviews.
- HSEC – monthly corporate HSEC meetings are held quarterly. Refer to Section 2.11 HSEC. Meeting minutes are prepared and made readily available to all staff.
- Board of Directors – Board of Directors meetings are held quarterly. The Health, Safety and Environment and Reserves Committee of the Board of Directors has further responsibilities. A quarterly report is provided to the Board of Director's.

3.9 Measurement and Continuous Improvement

Metrics and targets (KPI's) will be prepared and approved management on an annual basis. Quarterly scores will be prepared and reported at Board meetings. Annual performance will be evaluated high level results reported at the HSEC first quarter meeting.

Leading and lagging indicators will be tracked. Applying SMART (Specific, Measurable, Accountable, Reasonable, and Timely) principles is an effective approach to judging the merit and guiding the adoption of potential leading indicators. A baseline should be established for year over year comparison and industry comparison.

The following metrics should be tracked:

Leading Indicators

- Workers have training as specified in Section 4.0 Training.
- Corporate HSEC meetings held quarterly.
- Field safety meetings held monthly.
- HSE assessments completed as scheduled.
- Hazard and near miss reporting.
- Provincial energy regulator Liability Management Rating (LLR) and/or corporate health assessment.

Lagging Indicators

- Incident statistics (including: Pieridae employee LTI and recordable, contractor LTI and recordable, and regulatory reportable spills).
- TRIF (Pieridae employee LTI and recordable, and contractor LTI and recordable).
- Number of regulatory inspections and compliance status.
- Select GRI metrics (water usage, waste management, emissions) as may be applicable to the organization.

3.10 Documents and Records (Document Control)

In support of the HSE Program, the following documents will be available, and records maintained.

- Hard copies of the HSE Program will be controlled and a distribution list will be maintained.
- Soft copies of the HSE Program will be considered current as of the day sent. The precedent HSE Program documents will be housed at www.ikkumarescorp.com and www.pieridaeenergy.com.
- The HSE Program annual formal hazard assessment must be retained for three years (the HSE Program will be updated every three years in accordance with provincial OHS regulatory requirements).
- Worker HSE Program orientation records must be retained.
- Worker HSE training (certification) records must be retained.
- Worker competency records must be retained (e.g. CMDS).
- Records of regularly scheduled safety meetings (meeting minutes) will be retained for a period of two years.
- Records of the corporate joint health and safety committee must be made available within 7 days of the meeting and retained as per provincial OHS requirements.
- Records of incident and investigation reports will be retained for a minimum of two years. Incidents will be reported in the monthly HSE Report and tracked until closed.
- Records of hazard reports will be retained for two years. Hazards will be reported in the monthly HSE Report and tracked until closed.
- Records of regulatory inspection reports will be retained for two years. Regulatory inspections will be reported in the monthly HSE Report and tracked until closed.
- Records of regulatory audits will be retained for two years. Regulatory audits will be reported in the monthly HSE Report and tracked until closed.
- Safe work permits will be retained for one year. Safe work permits where an incident occurred will be filed in the incident investigation file and retained for a period of two years.
- Confined space entry permits will be retained for two years. Confined space entry permits where an incident occurred will be filed in the investigation file and retained for a period of two years.
- Ground disturbance permits and backfill inspection reports involving pipelines will be filed in accordance with the Pipeline Integrity Management Program.

- Records regarding a pipeline incident must be filed with the pipeline records for the life of the pipeline in accordance with the Pipeline Integrity Management Program.
- HSE Assessments must be retained for three years.

Section 4.0

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4.0 TRAINING

4.1 Introduction

Training is an important part of the overall HSE Program. Workers have the right to know, the right to participate in workplace health and safety, and the right to refuse dangerous work. HSE training is required to enable workers, and those that work in the capacity of work site supervisor, to carry out responsibilities and duties competently and supports the fundamental principle of continued improvement. Training ensures that workers have necessary job skills, explains the need for safe operations, improves communication and gives employees confidence to work properly and safely with regard for the environment. There are five categories of HSE training that are discussed in this section:

- Orientation;
- On-the-job training;
- Competency (production operators);
- Required training;
- Additional training; and
- Training records.

4.2 Orientation

Management must provide workers and work site supervisors with HSE training and information. The responsibility to conduct the orientation is by the supervisor that hires the new employee or work site supervisor. Due to the nature of Pieridae's operations there are two methods of conducting an orientation: an employee orientation or a work site supervisor HSE package.

- An employee orientation must be completed for: employees (e.g. operators, contract operators, Calgary and field office staff, and contract/consultant positions) that include a component of field work or supervising field work site supervisors or workers. Refer to Section 4.2.1 Employee Orientation.
- A work site supervisor HSE package must be distributed to: work site supervisors/project consultants (e.g. drilling, completions, pipeline/facility supervisors). Refer to Section 4.2.2 Work Site Supervisor HSE Package.

Contractors (e.g. third-party service providers) will be oriented by the work site supervisor that hires the contractor. Refer to Section 8.7 Contractor Orientation.

4.2.1 Employee Orientation

Every employee that is new to a work site must receive an orientation prior to starting work. HSE education will start when an employee joins the Company or is transferred to a new job. The orientation should be conducted by the supervisor or designated alternate. The general procedure will involve:

- Reviewing the resume, prior job history and certifications of the employee;
- Providing the employee with a copy of the HSE Program; and
- Discussing issues that relate specifically to HSE.

A new employee can be expected to absorb only a certain amount of information in the first few days. The supervisor should use the form as a guide for the HSE orientation which can also be used by the new employee as a reference (other onboarding materials may also be available). Refer to Appendix 1, Form 06 - Employee Orientation Checklist. The form includes information on administration, training/certificates, HSE, work site tour, site specific procedures and on-the-job training. The HSE Program orientation will include:

- HSE Program (access, hardcopies, softcopies and forms);
- HSE policy;
- HSE responsibilities;
- Right and obligation to refuse;
- Hazard identification and control;
- Safety meetings and corporate health and safety committee meetings and communication including the monthly HSE Report;
- PPE;
- Safe work permitting procedure;
- Contractor safety (orientation requirements);
- Hazard, near miss and incident reporting and investigation; and
- Corporate ERP and site specific ERPs that may be applicable;

The HSE Program is a policy and procedure manual that reflects Pieridae's objectives and it is the responsibility of new employees to be familiar with the program. The new employee must read and review the program and complete the Acknowledgement Form contained in the front of the binder. A copy of the Employee Orientation and the HSE Program Acknowledgement Form should be maintained on file as follows:

- New employee; and
- Supervisor.

4.2.2 Work Site Supervisor HSE Package

The work site supervisor HSE package has been specifically developed to address orientation of those contractors/consultants that work for Pieridae in the capacity of work site supervisor. As the work site supervisor on a Pieridae work site, these individuals have specific HSE responsibilities to ensure implementation of the Pieridae HSE Program. The HSE package is designed to facilitate implementation of HSE procedures. Work site supervisors include construction, drilling,

completion, pipeline/facility work site supervisors that are typically hired on an as-needed basis for a specific project. Work site supervisors are expected to comply with applicable government regulations and the Pieridae HSE Program and to demonstrate leadership in health, safety and environment.

The work site supervisor HSE package will be sent to the work site supervisor at the beginning of a new project by the hiring supervisor. Consultants that regularly work for Pieridae may keep the various HSE materials for reference. The package includes Pieridae's HSE Program (including an Acknowledgement Form that commits the receiver to reviewing the document), instructions on use of relevant procedures and forms, emergency contact information and training requirements. Once a project is complete, materials pertaining to the project must be returned to the hiring supervisor for review and file.

4.3 On-The-Job Training

As a follow up to the orientation, employees will receive on-the-job training. This allows for on-the-job reinforcement of the information presented to the employee during the orientation. On-the-job training provides hands-on experience in the proper work procedures for each job and helps to ensure that workers are competent to do the work.

On-the-job training will be provided to all workers new to a job or work site. It should also be conducted when work procedures or requirements change. Training should be conducted by supervisors or by employees that are thoroughly familiar with the work site and are competent in the particular job for which they are providing training.

New and/or inexperienced or transferred employees should be encouraged to ask questions at any time when doubt exists as to correct procedures.

The jobs with the highest priority for on-the-job training are those:

- Involving hazards;
- That are done frequently;
- Where there is a high worker turnover;
- Where accident/incidents have occurred; and
- With specific emergency response procedures.

4.4 Production Operator Competency

Competence is the ability to apply knowledge and skills to achieve intended results.

Production operator training is further augmented and documented through use of the CMDS as part of the Pressure Equipment Integrity Management System (PEIMS) otherwise known as ABSA critical task training and the Pipeline Integrity Management

Program. Pieridae uses the Competency Management and Development System otherwise known as “CMDS”.

4.5 Required Training

All employees directly involved with field operations must maintain valid certification in H_2S, WHMIS, TDG and First Aid/CPR. Additionally, operations representatives from each operating area must participate in annual area oil spill co-op exercises.

4.5.1 Hydrogen Sulphide (H_2S) Alive

- All employees that may be exposed to H_2S in the workplace are required to take a H_2S Alive certification course.
- Certification is valid for three years.
- Refer to Section 9.16 Hydrogen Sulphide (H_2S) and 5.10.2 Respiratory Equipment Training.

4.5.2 Workplace Hazardous Materials Information System (WHMIS)

- All employees who work with or in proximity to a hazardous product, or who directly supervise workers performing these duties must be trained in WHMIS.
- WHMIS training must be specific workplace and training materials should be reviewed annually or more frequently if required by a change in work conditions or available hazard information.
- Certification is available with a no expiry or can be renewed on a three year schedule.
- Refer to Section 6.6 Chemical Exposure/WHMIS.

4.5.3 Transportation of Dangerous Goods (TDG)

- All employees who handle, offer for transport, or transport dangerous goods must be trained and certified in TDG.
- Certification is valid for three years.
- Refer to Section 6.7 Transportation of Dangerous Goods (TDG).

4.5.4 First Aid/CPR

- All employees directly involved with field operations must be trained in First Aid/CPR training that meets provincial OHS requirements.
- Certification is valid for three years.
- Refer to Section 9.8 First Aid.

4.5.5 Oil Spill Co-operative Exercises

- It is a requirement under Alberta Energy Regulator (AER) regulations that a Pieridae representative attends the applicable area spill co-operative exercise.
- Exercises must be attended annually.
- Refer to Section 10.6 Spill Preparedness and Response.

4.6 Additional Training

The work site supervisor or hiring supervisor will assess training needs and determine optional training requirements or an employee may request optional training courses. Certain training is required if supervising activities (e.g. the AER requires that those individuals supervising ground disturbance have training).

4.6.1 Confined Space Entry

- Pieridae requires that confined space entry will be supervised and conducted by individuals that have Confined Space Entry training.
- Certification is valid for three years.
- Refer to Section 9.5 Confined Space Entry.

4.6.2 Basic Fire Training

- Workers should have a basic understanding of fire properties and fire extinguishing techniques.
- Workers should know how to use the fire extinguishing equipment at the work site. Various basic fire training courses are available and fire extinguisher suppliers can provide training on the use of firefighting equipment.
- Refer to Section 9.7 Fire and Explosion Hazard Management.

4.6.3 Incident Investigation

- Incident investigation should be done by those with experience in investigating incidents.
- Various courses are available and government workplace health and safety agencies also provide basic information online.
- Refer to Section 12.7 Investigation Procedures.

4.6.4 All-Terrain-Vehicle (ATV) Operator

- Prior to operating an ATV, operators should have general knowledge of operating ATVs and as a minimum should reference the owner's manual if unfamiliar with the ATV.
- Various courses are available.
- Refer to Section 9.2 All Terrain Vehicles (ATVs).

4.6.5 Ground Disturbance

- If supervising ground disturbance, the AER requires that the individual have ground disturbance training.
- Certification is valid for three years.
- Refer to Section 9.12 Ground Disturbance.

4.6.6 Gas Detection

- Worker should understand how to use various gas detection and personal monitors.
- Various gas detection courses are available. Suppliers that provide gas detection equipment may also provide training specific to the equipment provided.
- Refer to Section 5.11 Gas Detection Equipment (Personal Monitors) and 9.3 Atmospheric Testing.

4.6.7 Provincial Joint Health and Safety Committee Member Training

- Provincial requirements regarding OHS Committee training will be followed. Each province has its own requirements, based on provincial legislation, and therefore HSEC committee co-chairs will take the applicable provincial training for their area of operations (i.e. for the province where they work). Pieridae has a fully integrated HSEC. Refer to Section 2.11 Health, Safety and Environment Committee (HSEC).
- Alberta – HSC co-chair/HS representatives must take a mandatory prerequisite free, 2-hour, online course (Part 1), and a 6-8 hour training course by an approved agency.
- In BC - each member of a joint health and safety committee is entitled to eight hours of leave per year to attend occupational health and safety training courses run or approved by WorkSafeBC. In general, training includes: occupational health and safety responsibilities; workplace inspections; investigation of incidents; and task hazard analysis. Training can be provided by Pieridae or by a third party external provider. WorkSafeBC also provides an online course entitled Worker Health and Safety Representative Fundamentals.

4.6.8 Emergency Response Team Training

- Emergency response team members will receive ICS 100 training as a minimum.
- Emergency response team members will participate in the provincially required emergency response exercises as detailed in the provincial corporate and/or site specific emergency response plans. Refer to the applicable ERP.

4.7 Training Records

Training records are used to track current training and to plan future training needs. The following training records will be maintained for each employee:

- Employee Orientation;
- HSE Program Acknowledgment Form;
- Required training certifications at time of hire (H_2S, WHMIS, TDG, First Aid/CPR); and
- Additional training (as deemed appropriate and/or required based on job description).

Copies of certifications should be carried by employees and be made available upon request.

4.8 Drilling and Completions

Refer to Section 13.5.3 Drilling and Completion Training Requirements for additional requirements for wellsite supervisors.

Section 5.0

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5.0 PERSONAL PROTECTIVE EQUIPMENT

5.1 Introduction

Personal protective equipment (PPE) will help to reduce worker exposure to various work site hazards. Where hazards cannot be eliminated or reduced to a practical minimum through the use of engineering or administrative controls, then PPE and other safety equipment must be worn/used.

It is important to review material safety data sheets (M)SDS if working with chemicals as the (M)SDS provides information on the type of hazards associated with specific materials and the appropriate PPE that should be used. Additionally, signs should be posted in specific work areas where additional protection is required.

All PPE must be properly fitted, maintained, kept in a clean and sanitary condition, stored in proper designated areas and replaced when necessary.

This section will cover:

- Head protection;
- Hearing protection;
- Eye protection;
- Hand protection;
- Foot protection;
- Fire retardant clothing;
- Fall protection equipment;
- Respiratory protective equipment;
- Combustible gas meters; and
- Personal floatation devices.

5.2 Pieridae Standard PPE

Standard PPE to be worn on Pieridae operating work sites includes:

- hard hat;
- steel toed boots;
- fire retardant coveralls; and
- safety glasses.

Depending on the nature of the hazards at a work site other PPE may be required as specified on the safe work permit, and/or determined at the pre-job safety meeting or as described in site specific procedures. Signs will be posted in work areas where additional protection is required (e.g. hearing protection).

5.3 Head Protection

Hard hats must be worn at all times by workers and visitors on Pieridae work sites. Head protection must be Canadian Standards Association (CSA) approved. This gear must be well maintained and if damaged, replaced immediately. Refer to the date stamp on the hard hat to confirm the expiry date.

Where there is a risk of possible head injury to workers who operate All Terrain Vehicles (ATV's) or snowmobiles, protective headwear approved by either of CSA, ANSI (American National Standards Institute), Snell Memorial Foundation, or the British Standards Institution shall be worn. To be compliant this headwear must display the "DOT" mark.

5.4 Hearing Protection/Audiometric Testing Requirements

Whenever noise levels are greater than 85 decibels (dBA), workers entering the area must wear CSA approved hearing protection. Warning signs must be posted in areas where the noise level is greater than 85 dBA. It is the responsibility of the worker to wear hearing protection. Proper fit, care and maintenance is important.

A simple way to test whether noise levels could be hazardous is to talk to someone standing at arm's length away, and if you must raise your voice for that person to hear you, the noise is likely too loud. Hearing protection is important both on and off the job and workers can apply the skills learned at the workplace at home.

5.4.1 Noise Exposure Assessment

A noise exposure assessment must be conducted if workers are, or may be, exposed to noise at a work site in excess of the provincial noise exposure limits (85 dBA Lex over an 8 hour work day). Noise exposure assessments must be documented, and workers must be informed of the results. Noise level survey records are kept at field offices for a minimum of 2 years.

5.4.2 Warning Signs

Clearly visible warning signs shall be posted at all entrances to areas where the noise level exceeds 85 dBA or as required by the provincial regulations.

5.4.3 Noise Exposure Limits

L_{ex} is the sound level, energy-averaged over 8 hours. The table below provides different combinations of sound levels and exposure durations that are equivalent to 85 dBA L_{ex}.

Sound Level Occupational Exposure Limits

Sound Level (dBA)	Maximum Permitted Duration
82	16 hours
83	12 hours and 41 minutes
84	10 hours and 4 minutes
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes
100	15 minutes
103	8 minutes
106	4 minutes
109	2 minutes
112	56 seconds
≥115	0

*Note: “excess noise” is defined in the AB OHS Code as noise that exceeds 85 dBA Lex and the exposure limits listed above (excerpted from OHS Code, Schedule 3, Table 1).

Noise exposure assessments must also be conducted or updated when a change in equipment or process affects the noise level or length of time a worker is exposed to noise or when there is evidence of an occupationally induced hearing loss.

If a noise exposure assessment determines that workers are exposed to excess noise at the work site, then a noise management program must be implemented and include audiometric testing and an annual review of the effectiveness of the noise management program in preventing hearing loss (i.e. in addition to this procedure).

5.4.4 Selection of Hearing Protection Devices

Hearing protection devices are sound barriers that block a certain amount of sound energy transmitted from the surrounding environment to the middle and inner ear. Commonly used hearing protection devices can be categorized as earplugs, earmuffs and dual protection.

Hearing protection devices are assigned classes or grades based on laboratory attenuation measurements. The purpose of using a class/grade type system is to be able to make a quick determination as to an appropriate type of hearing protection for a known noise level exposure.

Selection of Hearing Protection Devices

Maximum equivalent noise level (dBA L_{ex})	CSA Class of hearing protection	CSA Grade of hearing protection
≤ 90	C, B or A	1, 2, 3, or 4
≤ 95	B or A	2, 3, or 4
≤ 100	A	3 or 4
≤ 105	A	4
≤ 110	A earplug + A or B earmuff	3 or 4 earplug + 2, 3, or 4 earmuff
> 110	A earplug + A or B earmuff and limited exposure time to keep sound reaching the worker's ear drum below 85 dBA L_{ex}	3 or 4 earplug + 2, 3, or 4 earmuff and limited exposure time to keep sound reaching the worker's ear drum below 85 dBA L_{ex}

Noise Reduction Rating (NRR) values are another way to determine the protection provided by a hearing protector. The NRR is a rating system that estimates the actual sound protection provided by hearing protectors when worn in actual working environments. As an example, if the workplace noise is 98 dBA, and an earplug with a NRR of 29 dB is worn, the estimated noise exposure is reduced to 86.5 dBA (not 98 – 29 = 69). The NRR has an effective rating based on the device type, so it is not simply a subtraction of workplace noise and NRR.

Device Type	For use with dBA	Effective Rating
Earplugs	Leq – NRR (0.5) -3 = xx dBA	50%
Earmuffs	Leq – NRR (0.7) -3 = xx dBA	70%
Dual protection	Leq – NRR (0.6) -3 =xx dBA	60%

Using the previous example:

Workplace noise time-weighted average = 98 dBA

Earplug with NRR = 29 dB

Estimated noise exposure = 98 – [(29)(0.5)-3] = 86.5 dBA

5.4.5 Fit, Care and Use of Hearing Protection Devices

It is the responsibility of the worker to wear hearing protection. Workers should be trained to recognize:

- Unless hearing protection devices are worn above 85 dBA Lex, there is some risk of hearing loss;
- Identification of noise hazards on site and areas where hearing protection devices are required.
- The various types of hearing protection devices available;
- Proper fit of the hearing protection devices;

- Proper cleaning, handling and storage of hearing protection devices;
- Manufacturer's instructions for use, including any special considerations for use with other protection devices such as respirators, goggles, etc.

The following general considerations regarding proper fit, care and use of hearing protection devices are important to ensure maximum effectiveness of the device:

- For maximum protection, a hearing protection device shall make a tight seal with the ear canal or against the side of the head.
- Earplugs shall be fitted snugly (but not so tightly as to cause discomfort) in the ear canal. If there is ongoing discomfort, re-sizing may be required or in some cases earmuffs or custom-molded earplugs may be recommended.
- The effectiveness of earmuffs depends on an airtight seal between the cushion and the head. Therefore, hair, jewelry, or clothing shall not be worn in such a manner as to be caught between the cushion and the head.
- Hearing protection device effectiveness is greatly reduced if it is removed even for short periods;
- Sweating commonly makes the use of earmuffs uncomfortable. Sweat covers can slightly reduce the performance of the muff, but they may improve comfort.
- Certain chemicals can degrade the hearing protection device; therefore, caution shall be taken to keep the protector clean.
- Clean hands should be used when inserting and removing earplugs. Contaminated earplugs can cause ear irritation or infection.
- Prior to use, the integrity of the device shall be checked and the device replaced if any deficiencies are noted.
- Devices shall be cleaned and stored as recommended by the manufacturer to ensure proper function.
- Earmuff cushions should be replaced as soon as they lose their shape, become hard or brittle, show evidence of cracks, or otherwise lose their performance qualities. As a rule of thumb, ear cushions should be changed every 6 months, and the entire muff every 2 years.
- Earmuff headband tension may be reduced over time and may require repair or replacement.

Core production facilities should maintain an adequate stock of hearing protection devices to ensure that any deficient and/or damaged hearing protection devices can be replaced and/or repaired as required.

5.4.6 Audiometric Testing

As per OHS regulations, any employee that is a noise exposed worker shall undergo audiometric testing. Pieridae full-time employees that are noise exposed workers will be tested. Audiometric testing records are confidential and are maintained as such by the audiometric testing company.

- In Alberta, noise exposed workers must be tested within 3 months after becoming a noise exposed worker; and at least once every year after the baseline test, and every two years thereafter.

- In BC, noise exposed workers must receive an initial hearing test as soon as practicable after employment starts, but no later than 6 months after the start of employment; and at least once every 12 months after the initial test.

5.5 Eye Protection

CSA approved and properly fitted eye protection will be worn when performing any task where a possible eye injury or irritation to the eye could occur at work sites. All safety glasses and prescription safety glasses must be CSA approved against shatter damage.

CSA approved goggles or face shields will be provided to employees and must be worn whenever the nature of the work being performed requires special protection to the face or eyes. Examples include the following:

- Grinding, cutting, welding, chipping, scraping or cutting;
- Painting;
- Handling chemicals;
- High-pressure washing;
- Pressure testing;
- Near to, or working with, compressed air and hoses;
- When draining or breaking joints; and
- When lighting boilers and fire tubes.

5.6 Hand Protection

Hand protection must be worn when handling sharp or jagged objects and approved safety gloves must be worn when handling hazardous chemicals. Refer to the (M)SDS to determine the appropriate protection required when using chemicals.

5.7 Foot Protection

CSA approved steel-toed footwear is required on all Pieridae work sites. Footwear must have the following mark:

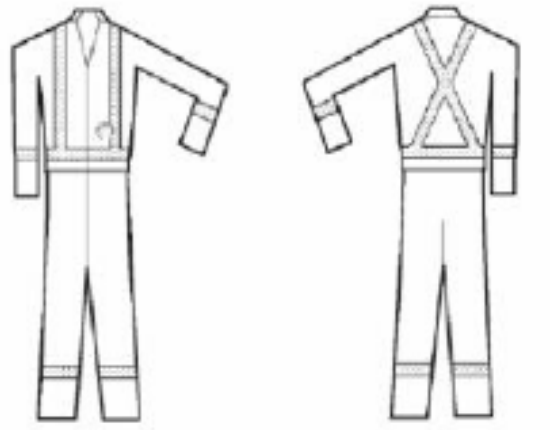
5.8 Fire Retardant Clothing

Fire retardant clothing is required on all Pieridae sites in order to minimize the exposure to possible burn related injuries. Fire retardant clothing must be worn in all Class I areas.

In general, only clothing suitable for the job and work site will be worn. Clothing must not be ragged or torn and it must be kept reasonably clean. Clothing which does not adequately cover the body such as shorts or working with no shirt is not permitted. Clothing worn beneath flame resistant outerwear and against the skin should be made of flame resistant fabrics or natural fibres (e.g. wool, cotton, silk) that will not melt when exposed to heat.

5.8.1 High Visibility Markings

Coveralls must have high visibility marks.



5.8.2 Fire Retardant Coverall Maintenance

- For coveralls made from inherent fire retardant fibers (i.e. Nomex III, Nomex IIIa, Kevlar), the fire retardant factor cannot be washed out, however dry cleaning is recommended to reduce shrinkage and to remove petroleum based stains.
- For treated cotton fabrics (i.e. Proban), the fire retardant factor can be washed out, therefore the manufacturer recommends approximately 35 washings before the coveralls should be taken out of service.
- Avoid washing fire retardant clothing with chlorine bleach.
- Repairs are to be made with fire retardant fabric similar to the coverall.
- It is recommended that fire retardant coveralls be taken out of service when large petroleum based stains remain in the fabric after washing or dry cleaning or when the coveralls show obvious wear (usually in the back, elbows, and knees), as the fire resistance of the fabric will be reduced.

5.8.3 Electrical PPE

As deemed appropriate by a qualified electrical worker, appropriate arc-rated clothing and personal protective equipment shall be used by the worker and selected on the basis of the incident energy exposure associated with the specific task and/or be based on the hazard/risk category method. All parts of the body inside an arc flash protection boundary shall be protected (e.g. head, face, neck

and chin; eye protection; body protection, hand and arm; and foot and leg protection as appropriate). Insulated tools and equipment (e.g. ladders, safety signs and tags, covers, line hoses, temporary grounding etc.) must also be used as deemed appropriate. Qualified electrical workers must follow requirements specified in CSA Z642. Electrical footwear will have the following mark:

5.9 Fall Protection Equipment

In both Alberta and BC, a worker must be protected from falling at a temporary or permanent work area if a worker may fall: a vertical distance of more than 3m; a vertical distance of less than 3m if there is an unusual possibility of injury; or into or onto a hazardous substance or object, or through an opening in a work surface.

The worker must be protected from falling by:

- A guardrail around the work area;
- A fall restraint system (a system to prevent a worker from falling from a work position, or from travelling to an unguarded edge from which the worker could fall); or
- A fall arrest system (a system that will stop a worker's fall before the worker hits the surface below).
- If guardrails, fall restraint, or fall arrest are not practicable, or will result in a greater risk of injury, contact OHS to discuss alternative safe work procedures that may be acceptable.

Options for protection include equipment such as scaffolds, aerial lifts, fall arrest systems, or control zones. Regardless of the type of protection used, the equipment must be inspected and maintained as per manufacturer's specifications. Refer to Section 9.34 Working at Heights.

A personal fall protection system means a worker's fall restraint system or fall arrest system composed of: a safety belt or full body harness, and a lanyard, lifeline and any other connecting equipment individual to the worker that is used to secure the worker to an anchor, an anchorage or a horizontal lifeline system. Where required, CSA approved body harnesses, safety belts and lanyards must be used.

Before a worker is allowed into an area where a risk of falling exists, the employer must ensure that the worker is instructed in the fall protection system for the area and the procedures to be followed.

A worker must use the fall protection system that is provided by the employer.

Provincial requirements for anchors must be met. Refer to the appropriate regulations.

5.9.1 Fall Protection Plan

- In Alberta, if a worker at the work site may fall 3m or more and the worker is not protected by a guardrail a fall protection plan must be developed. The plan must include procedures for rescuing workers who have fallen.
- In BC, the employer must have a written fall protection plan for a workplace if work is being done at a location where workers are not protected by permanent guardrails, and from which a fall of 7.5m (25ft) or more may occur.
- If the work site supervisor identifies the need for fall protection either through a pre-job safety meeting, during the safe work permitting process, or through job hazard analysis additional planning may be required. For Pieridae workers, a site specific procedure can be developed. Training needs must also be addressed in the fall protection plan.
- In the case of contractors working on their own equipment on an Pieridae work site, fall protection should be addressed during a pre-job safety meeting (e.g. issuance of an Pieridae safe work permit and completion of the contractor's field level hazard assessment and/or review of the contractors fall protection procedures). For example, drilling or service rig companies may have a very comprehensive fall protection plan complete with training and a reduced fall height (i.e. less than 3m). If the contractor has more stringent requirements in place, the most stringent requirements should be used by workers.

5.9.2 Fall Protection Equipment Inspection and Maintenance

- Inspect equipment before use.
- Maintain equipment in good working order.
- Replace defective equipment. If there is any doubt about the safety of the equipment, do not use it.
- Replace any equipment, including ropes, involved in a fall. Refer any questionable defects to a trained inspector.
- A trained inspector should examine equipment at least yearly and be certified as specified by the manufacturer.
- It is advisable to use shock absorbers if the arresting forces of the lanyard alone can cause injury.
- After a fall protection system has arrested the fall of a worker, it must be removed from service and not be returned to service until it has been inspected and recertified as safe for use by the manufacturer or its authorized agent, or by a professional engineer.

5.9.3 Training

Various fall protection courses are available. The supervisor should assess the training needs and determine if additional training is required (i.e. if an Pieridae worker is required to don a personal fall arrest system, fall protection training should be provided and documented).

5.10 Respiratory Protective Equipment

Workers should use respirators for protection from contaminants in the air only if other hazard control methods are not practical or possible under the circumstances. Respirators should not be the first choice for respiratory protection and should only be used:

- when following the "hierarchy of controls" is not possible (i.e. elimination, substitution, engineering or administrative controls);
- while engineering controls are being installed or repaired;
- when emergencies or other temporary situations arise (e.g. maintenance operations).

When workers may be exposed to airborne contaminants exceeding occupational exposure limits, respiratory protective equipment must be worn. The airborne contaminant should be identified and occupational exposure limits verified (e.g. hydrogen sulphide; oxygen deficiency; silica dust; chemical fumes; etc.).

- an atmosphere that is immediately dangerous to life and health (IDLH);
- an atmosphere the is oxygen-deficient (less than 19.5% oxygen); or
- when airborne contaminants exceed the occupational exposure limit.

In Alberta, OHS requires that a Code of Practice be developed describing the selection and use of respiratory equipment whenever respirators are used at a work site. This section, together with other parts of this HSE Program manual and any site specific practices that may be in place for a particular area/facility, was developed to address that requirement.

5.10.1 Determination of Need for Respiratory Protective Equipment

An appropriate respirator must be selected in accordance with CSA Standard CAN/CSA-Z94.4-93, Selection, Use, and Care of Respirators.

It is the responsibility of the work site supervisor together with the worker (and the occupational health and safety committee as may be appropriate, i.e. in BC) to select, provide and ensure that the equipment is properly maintained. All respiratory protective equipment must have a stamped approval by a recognized testing authority such as the National Institute of Occupational Safety and Health (NIOSH) or the Mine Safety and Health Administration (MSHA).

To aid in determining need, consider the following questions:

- What is the nature of any contaminants?
- What is the concentration or likely concentration of any airborne contaminants?
- What is the duration or likely duration of the exposure?
- What is the toxicity of the contaminant?
- What is the partial pressure and concentration of oxygen?
- Are there warning properties of the contaminant?

- What is the need for emergency escape?
- Can the worker wear a respirator? Identify any sensitivities or allergies that a worker may have that may impact the worker and either require use of a respirator in cases where it would not normally be expected and/or identify if there is any doubt about a worker's ability to use a respirator for medical reasons. If there is any doubt about a worker's ability to wear a respirator, a medial assessment should be completed by a physician.

5.10.2 Respiratory Equipment Training

In addition to H_2S Alive training, workers are required to participate in any training regarding the inspection, fit, proper use and care of respiratory equipment to ensure optimum protection against respiratory hazards. Training will include:

- An explanation of the operation, limitations and capabilities of the respiratory equipment used. Instruction for inspection, donning, removal, fit, basic maintenance, cleaning and storage.
- Wearer's must be able to recognize improper fit of respiratory equipment.

Work site supervisors are responsible to monitor, correct and determine suitable use of respiratory equipment. Any training conducted at the work site must be documented and shall include details such as who conducted the training (i.e. a supplier); the names of those who received training, date and the type of equipment the worker has been trained to use. A suggestion would be that training is conducted during safety meetings and the training information could then be included on the safety meeting minutes form.

5.10.3 Respiratory Equipment Types and Selection

Respiratory protective equipment falls into three general categories or types:

Self Contained Breathing Apparatus (SCBA)

- SCBA is approved for use in IDLH (Immediately Dangerous to Life and Health) atmospheres. This apparatus supplies air from a cylinder worn on the worker's back to a face piece that covers the worker's entire face, including eyes. It must be of the type that maintains positive pressure in the face piece and provides air on demand. The cylinder must be rated to supply air for at least 30 minutes (this time could lessen under extreme exertion) and must be equipped with a low-pressure alarm (i.e. that warns the wearer when approximately 20-25% of the service time is remaining).

Supplied Air Breathing Apparatus (SABA)

- SABA is approved for use in IDLH atmospheres. This apparatus supplies respirable air from remote cylinders or a remotely located compressor valve via a hose to a face piece that covers the worker's entire face. It must be of the type that maintains positive pressure in the face piece and provides air on demand. An emergency escape bottle (egress cylinder) must be worn with SABA in the event of supplied air interruption. The escape bottle is for escape only and must never be used for routine operations within a toxic environment.
- Air used in either SCBA or SABA, must be certified by CSA Standard CAN3-

Z180.1-M85 “Compressed Breathing Air and Systems”.

Air Purifying Respirators (APR’s)

- APR’s are devices for filtering or purifying air the worker breathes. These respirators must never be used in IDLH atmospheres or in atmospheres where contaminant concentrations exceed the maximum stated by the manufacturer for that specific piece of equipment. The APR in use will have some means by where the wearer can determine the end-of-service date of the filter or cartridge before contaminants can breakthrough.
- A mechanical filter offers protection against one or a combination of airborne materials such as dusts, mists, metal fumes or smoke.
- A chemical cartridge offers protection against a single airborne gas or vapor or a single class of airborne gases or vapors by means of a chemical sorbent within the cartridge. Examples of airborne gases or vapors are alkaline and acid gases, mercury vapors, pesticides, paint vapors and mists or mixtures of these.
- A gas mask (canister type masks) protects against concentrations of organic vapors or gases, alkaline or acid gases, pesticides, paint vapors or mists, radioactive particulate and fumes. Should a worker using this type of device detect odor, abnormal breathing, overheating of the canister or any other indication of a malfunction, the worker must immediately return to a safe atmosphere.

5.10.4 Fit Testing Requirements and Procedures

Prior to the use of respiratory equipment, any facial hair that may interfere with the proper sealing of equipment is to be removed unless fit testing has been completed. Workers must adhere to the facial hair policy. Refer to Section 2.2 General Rules.

Fit tests ensure:

- An effective tight seal to the face is achieved and maintained;
- Prescription glasses do not interfere with the seal of the face piece to the face;
- Personal protective equipment does not interfere with the seal of the face piece to the face of the wearer; and,
- Effective communication can be maintained while wearing respiratory equipment (i.e. equipment equipped with a speaking diaphragm).

The face piece seal capability of SCBA, SABA and APR’s shall be verified by qualitative fit testing on an annual basis and any time that new types of respiratory equipment is used. A qualitative test is required for each worker before being permitted to wear SCBA, SABA or APR’s in a hazardous atmosphere.

Performance checks (user seal checks) must be conducted immediately before going into a hazardous atmosphere each time that respiratory equipment (SCBA, SABA, APR’s) is donned.

All fit tests must be conducted by a competent person. Fit testing must be completed in all circumstances where there is a need for respiratory protective equipment. The types of fit tests are described below.

Qualitative Fit Tests

This type of fit test is sensory. It tests the quality of the face-to-face piece seal. Either olfactory or taste senses can be used to determine if an effective seal has been achieved. This test is pass or fail and does not obtain a numerical measurement of fit (i.e. the magnitude of respirator leakage).

- **Olfactory** - Banana oil (Isoamyl Acetate vapor) is a common agent used in qualitative fit tests. The banana oil ampoule can be passed close to the respirator near the sealing surface. If the wearer detects no smell of the oil, the fit is adequate.
- **Taste** - Sugar solution can be used to test APR's. The solution is misted around the filter and if the wearer detects no sweet taste in their mouth, then the fit is adequate.

Quantitative Fit Tests

This test uses instrumentation and a series of exercises that simulate work movements to quantify and measure the effectiveness of the facial seal. The instrumentation measures pressure and aerosol concentration inside and outside the face piece and to determine leakage. An advantage to this test is that it is not subjective like the qualitative test (i.e. using senses to determine leakage) and it provides a numerical measurement of fit.

Performance Checks (User Seal Checks)

A qualitative or quantitative fit test should not be confused with a performance check or user seal check. The user seal check is used only after a proper fit test has been completed to determine proper sealing of the face piece to face seal before entering the atmosphere. Wearer must receive a proper fit testing on an annual basis.

- **Negative Pressure Test** – Close off the inlet opening of the respirator by covering the opening with the palm of your hand, inhale gently (the face piece will collapse slightly) and hold breath approximately 10 seconds. If the face piece remains collapsed and no inward leakage is detected, the respirator fit is adequate.
- **Positive Pressure Test** – Close off the exhalation valve and exhale gently into the face piece. The fit is satisfactory if a slight positive pressure can be maintained without any evident outward leakage.

Records

Fit testing records must be kept and the records must outline who the worker was that was tested, the type of fit test performed, the model of the face piece and the

results of the test (being satisfactory or unsatisfactory). A suggestion would be for fit testing to be conducted at a safety meeting and recorded in the meeting minutes.

5.10.5 Maintenance, Cleaning and Storage

Each respirator should be properly maintained to retain its original effectiveness. All respiratory equipment shall be stored in a manner to protect them from chemical and physical agents such as vibration, shock, sunlight (UV), heat, extreme cold and excessive moisture. Respiratory equipment shall also be stored in a manner that prevents the distortion of rubber or elastomeric parts. All respiratory equipment must be stored in areas that are clearly marked.

Breathing Air

When compressed breathing air is used, the quality of the breathing air must comply with CSA Z180.1-00 Compressed Breathing Air Systems (Table 1) and occupational health and safety exposure limits.

Cleaning and Sanitizing

Respirators must be cleaned and sanitized after each use and before being worn by different individuals. After being cleaned, each respirator shall be inspected to determine if it is suitable for continued use.

- Remove filters, cartridges or canisters. Disassemble face pieces by removing speaking diaphragms, demand and pressure demand valve assemblies, hoses or any components as recommended by the manufacturer. Discard, or tag for repair, any parts that are damaged or defective.
- Wash components in 50°C water with mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle brush may be used to facilitate the removal of dirt.
- Rinse thoroughly in clean warm running water. Wipe all surfaces with the manufacturer's recommended disinfectants and rinse again. Any detergents or disinfectants that are not rinsed well can cause dermatitis.
- Hand dry with a lint free cloth or air dry. Reassemble and test the respirator to ensure proper operation.

5.10.6 Inspection and Servicing

Inspection shall be conducted prior to each use according to the manufacturer's instructions to ensure proper and safe operation of the equipment.

Defective equipment shall be tagged as such and set aside for repair. All repairs are to be conducted by qualified personnel and all replacement parts must meet the manufacturer's specifications. Maintenance service shall be conducted according to the manufacturer's instructions. Equipment stored for emergency purposes shall be inspected monthly. General requirements for inspection are as follows:

Overall Inspection

Check for excessive dirt, cracks, tears, holes or physical distortion. Check for cracked or badly scratched lenses and incorrectly mounted lenses. Check the regulator and alarms and ensure proper function. Check hoses, gauges and the tightness of connections. Check electrical components (batteries, chargers, etc.). Check rubber or elastomeric parts for pliability and signs of deterioration.

Head Harness Inspection

Check for wear, loss of elasticity, broken or malfunctioning buckles and attachments, and worn serration on head harness straps which might permit slippage or permit contaminant breakthrough.

Exhalation Valve Inspection

Check for foreign material, cracks, tears, improper insertion of the valve body in the sealing surface, missing or defective valve cover.

Corrugated Breathing Tube Inspection

Check for broken or missing connections, missing or loose hose clamps and deterioration (i.e. stretching tube and looking for cracks).

Harness Inspection

Check for damage or wear to canister holder, badly worn or broken straps.

Cylinder Inspection

Check the cylinder for obvious signs of damage. Ensure that cylinders have been filled to the manufacturer's specified pressures. Cylinders must be stored at a minimum of 70% of capacity while not in use.

APR Inspection

Check for the correct cartridge, canister, or filter for the work being done, correct installation, badly worn threads, expired shelf life, cracks or dents in the inside of the case filter and the absence of sealing material (i.e. tape, foil) over the inlet. Determine when the end of service and/or shelf life is reached. Check for badly worn threads.

5.11 Gas Detection Equipment (Personal Monitors)

5.11.1 Introduction

There are two forms of gas detection equipment:

- fixed (permanently installed in a chosen location to provide continuous monitoring of equipment for early detection of leaks in an enclosed space); and
- portable (refers to a small, handheld device that can be used for testing an atmosphere in a confined space before entry, for tracing leaks, or to give an early warning of the presence of flammable gas or vapor when hot work is being carried out in a hazards area).

This section will focus on PPE referred to as “personal monitors”. Personal monitors are used to monitor the atmosphere around a worker and are worn on clothing. Personal monitors are battery operated and transmit warnings via audible and/or visual alarms when dangerous levels of gas vapors are detected.

5.11.2 Atmospheric Hazards

Hazards posed by gases can be classified into three categories: toxic, asphyxiating and combustible. Four gas monitors (multi-gas) are typically configured with sensors to address each of these scenarios for a given worksite or scenario and are common throughout the oil and gas industry. A four head monitor measures:

- Oxygen (0_2) - Oxygen is required to breathe and an acceptable range is between 19.5%-23%. Oxygen can be displaced by other gases, causing oxygen deficiency. Oxygen deficient environments present a suffocation hazard. Oxygen enrichment (more than 23.5%) occurs when oxygen concentration exceeds that of fresh air, potentially increasing the risk of combustion of flammable gases.
- Lower Explosive Limit (LEL) - LEL measures combustible gases that pose a risk of explosion. LEL sensors detect the concentration of flammable or explosive gases and alert the worker if the level of gas surpasses the pre-configured concentration below the lower explosive limit (LEL), well before the potential for explosion occurs. Although the target should be zero, regulatory requirements are 20% of LEL.
- Hydrogen sulphide (H_2S) - H_2S is a toxic poisonous gas. H_2S sensors can be set to alarm at the occupational exposure limit of 10ppm. Refer to Section 9.16 Hydrogen Sulphide.
- Carbon monoxide (CO) – CO is an asphyxiating gas caused by incomplete combustion. The occupational exposure limit is 25ppm.

It is vital to worker safety that these monitors be properly configured, calibrated, and maintained. The purpose of a gas detector is to give a warning of a potential problem. The actions to be taken if the alarm sounds should be understood and communicated. The limitations of the monitor should also be understood (i.e. over-ranging).

In all cases, refer to the Manufacturer’s specifications and User Manuals for information specific to the device.

5.11.3 Limitations of Combustible Gas Monitors (Measuring LEL)

Before starting work that involves exposure to an atmosphere that may contain a flammable or explosive gas, the atmosphere should be tested with a combustible gas meter. The combustible gas meter must meet all requirements of CSA Standard C22.2 No. 152. Meters that are CSA approved will bear a CSA certification mark and may be used in Class 1 hazardous locations. It is extremely important that the meter provides accurate measurements and is fully functional.

Prior to using a gas monitor, check to determine how the concentration of combustible gas is measured by the instrument (i.e. in % LEL or % by volume), as the different scales must be interpreted correctly to properly assess the hazard. Most personal combustible gas monitors measure in % LEL, but this has to be verified prior to use. If a gas monitor reads in % LEL, it is reading 0-100% of the LEL of the gas it was calibrated to, with a reading of 100% LEL indicating that it is at the gases LEL. To ensure the health and safety of workers, gas monitor readings in work areas should not exceed 20% of the LEL.

For example, the LEL of methane gas is 5.3%.

- A monitor that reads in % by volume will indicate 5.3% on the gauge/screen when this amount is measured.
- A monitor that reads in %LEL will read 100% LEL on the gauge/screen when this amount is measured.
- Important: This is a critical difference when interpreting the reading for methane and the two scales must not be confused.

Combustible gas monitors require sufficient oxygen levels to function accurately and since oxygen levels decrease as the UEL levels increase, most combustible monitors will not perform accurately after the 100% LEL level is reached. Some instrument models will shut down after 100% LEL on an over range protection feature to minimize sensor damage.

Combustible gas meters can only be expected to respond accurately to the gas for which it was calibrated. To measure other gases with the same meter, consideration must be given to the specific properties of the gas and of the detector. Some instrument manufacturers have responded to the need to estimate more accurately the concentration of other gases by providing correction factors which allow the calculation of % LEL from the measured level. Consult the user's manual for information specific to a particular monitor.

Combustible gas meters cannot be relied upon to:

- Accurately measure highly toxic gases such as H_2S (i.e. the danger to health is usually of much greater concern than explosivity);
- Respond accurately in atmospheres which do not contain 20.9% oxygen in air (i.e. oxygen concentrations in the air lower than those normally occurring in the atmosphere may result in underestimating the explosive hazard);
- Provide a reliable indication of the explosive hazard when meters are not calibrated before each use; or
- Compensate for poor field sampling technique or an operator/user failure to consider conditions of the work environment (i.e. acclimatize the monitor in extreme temperatures, especially cold temperatures).

Refer to Section 9.3 Atmospheric Testing for more information.

5.11.4 Bump Testing

Workers that use personal monitors must take care of the instrument to ensure effectiveness.

There are a variety of conditions that can affect the reliability of personal monitors.

- Moisture condensing on sensor filaments – this may cause filaments to short circuit or fracture;
- Exposure to high concentrations of combustible gases – this will shorten the effective life of the sensor;
- Exposure to high concentrations of dust – gas sensors filters can be slowed or blocked;
- Exposure to catalytic sensor poisons – substances such as silicone compounds (e.g. WD-40, sulphur compounds, or chlorine can coat, corrode or inactivate sensor filaments);
- Mechanical damage – sensors can stop working if a monitor is dropped; and
- Immersion in water – sensors can stop working if a monitor is immersed in water.

The only way to ensure that a personal monitor is accurate and fully functional is to complete a function test or "bump" test before use, as per manufacturer's specifications.

A bump test is a test that is done at the start of each shift or before the monitor is used. The test makes sure that the monitor is working properly. During a bump test, the monitor is exposed to a known concentration of calibration gas. If the monitor responds within predetermined limits defined by the manufacturer, the instrument is ready for use. No attempt is made to re-calibrate the monitor during a bump test.

A monitor that fails a bump test must immediately be taken out of service and returned to a qualified person or facility for a complete inspection and recalibration.

Bump tests should be recorded.

5.11.5 Calibration

Equipment must be calibrated according to manufacturer's specifications.

5.11.6 Record Keeping

Where personal monitors are required at production facilities, a site specific procedure should be developed to facilitate training, use, and maintenance (including recording bump tests and calibration schedules). Personal monitor calibration should also be added to preventative maintenance schedules. Refer to Appendix 1, Form 20 – Site Specific Procedure (template).

5.12 Lifejackets and Personal Flotation Devices

A lifejacket or personal flotation device shall be worn when working from a boat, or in a situation that involves working over water or on the banks of a river, lake, or other body of water (i.e., drainage ponds). Lifejackets or personal flotation devices must meet CSA standards.

Section 6.0

Table of Contents

6.0 HAZARD IDENTIFICATION AND CONTROL

6.1 Hazard Identification and Control

6.1.1 Introduction

Every work site contains hazards that must be controlled to ensure worker safety. The oil and gas industry is generally considered to be high hazard work due to the inherent nature of the products that are handled.

A hazard is a source with potential to cause injury and ill health. Hazards include the potential to cause harm or hazardous situations, or circumstances with the potential for exposure leading to injury and ill health.

During hazard assessment, both health and safety hazards should be assessed. A health hazard is anything that could harm the health of a worker, either immediately or over time (e.g. exposure to chemicals). A safety hazard is anything that could cause immediate injury or damage (e.g. working at heights, moving equipment, toxic atmospheres, flammable environments, etc.). A common way to define hazards is by category:

- physical - lifting heavy loads, repetitive motions, vibrations, slipping/tripping hazards, working at heights, working around moving equipment/vehicles, extreme temperatures, poor lighting, working alone, noise, violence, radiation, pressure extremes (high pressure or vacuum), etc.
- chemical – depends on the physical, chemical and toxic properties of the chemical (toxicity, fumes, vapors, gases, byproducts/waste products from a process, etc.)
- biological – bacteria, viruses, insects, plants, birds, animals, animal/pest waste, molds, bodily fluids, sewage
- psychological – harassment and bullying, stress, fatigue, violence

A challenge of conducting effective hazard assessment is that not all hazards are obvious to every worker. Workers bring individual experience and judgement to the task of identifying hazards. The industry or workplace culture can build up a level of risk tolerance, or workers can become complacent and lower the level of diligence over time, as high-hazard activities become familiar. New workers may simply not have the experience to identify hazards at the work site or may willingly take risks. More experienced workers may have the difficulty changing behavior as new procedures are introduced. It is for this reason that effective hazard assessment and control is the responsibility of every worker – “if you see something, say something”.

Hazard assessment and control forms the basis of the Pieridae HSE management system. Once a hazard is identified, a hierarchy of controls can be applied and used including: elimination (or substitution); engineering controls; administrative controls (written procedures); and personal protective equipment.

All workers are responsible to help identify hazards, unsafe equipment, unsafe work procedures and work practices. Hazardous situations can result in incidents (i.e. injuries or illnesses, property damage, spills, releases, vehicle accidents, contractor accidents, fires, explosions, etc.).

Communication is an integral and vital part of hazard identification and control.

When in doubt – STOP – and ask the work site supervisor for further clarification.

The purpose of this section is to:

- Explain the right and obligation to refuse dangerous work;
- Define procedures for communicating hazards;
- Explain the hierarchy of controls;
- Present a basic risk assessment process;
- Describe the annual formal hazard assessment procedure and how it is used to develop standard operating procedures;
- Explain the job hazard assessment procedure and how it is used to develop site specific procedures;
- Explain hazard alert/near miss reporting procedure.

6.1.2 Right and Obligation to Refuse

Across Canada, there are laws to protect workers on the job. This occupational health and safety legislation gives three important rights to all workers to ensure they have the knowledge needed to be safe on the job and the freedom to participate in health and safety activities at the workplace. These rights include: the right to know, the right to participate and the right to refuse dangerous work. Refer to provincial regulations.

Workers can refuse if there is reason to believe that the situation is unsafe to the worker or co-workers.

A worker who refuses dangerous work must report the circumstances to the supervisor without delay. The supervisor must investigate the matter and work to resolve the issue without delay. In all cases, steps must be taken to resolve the issue. If the issue cannot be resolved, workers can contact a Pieridae HSEC member, or the Safety Ombudsman. If the problem still cannot be resolved, a government OHS Officer/Inspector can be contacted.

Additionally, workers that feel that sufficient training to complete the work has not been received may refuse to perform the work and seek further clarification and instruction from the work site supervisor.

Worker refusals should be documented using the hazard alert/near miss reporting procedure. Refer to 6.1.8 Hazard Alert/Near Miss Reporting.

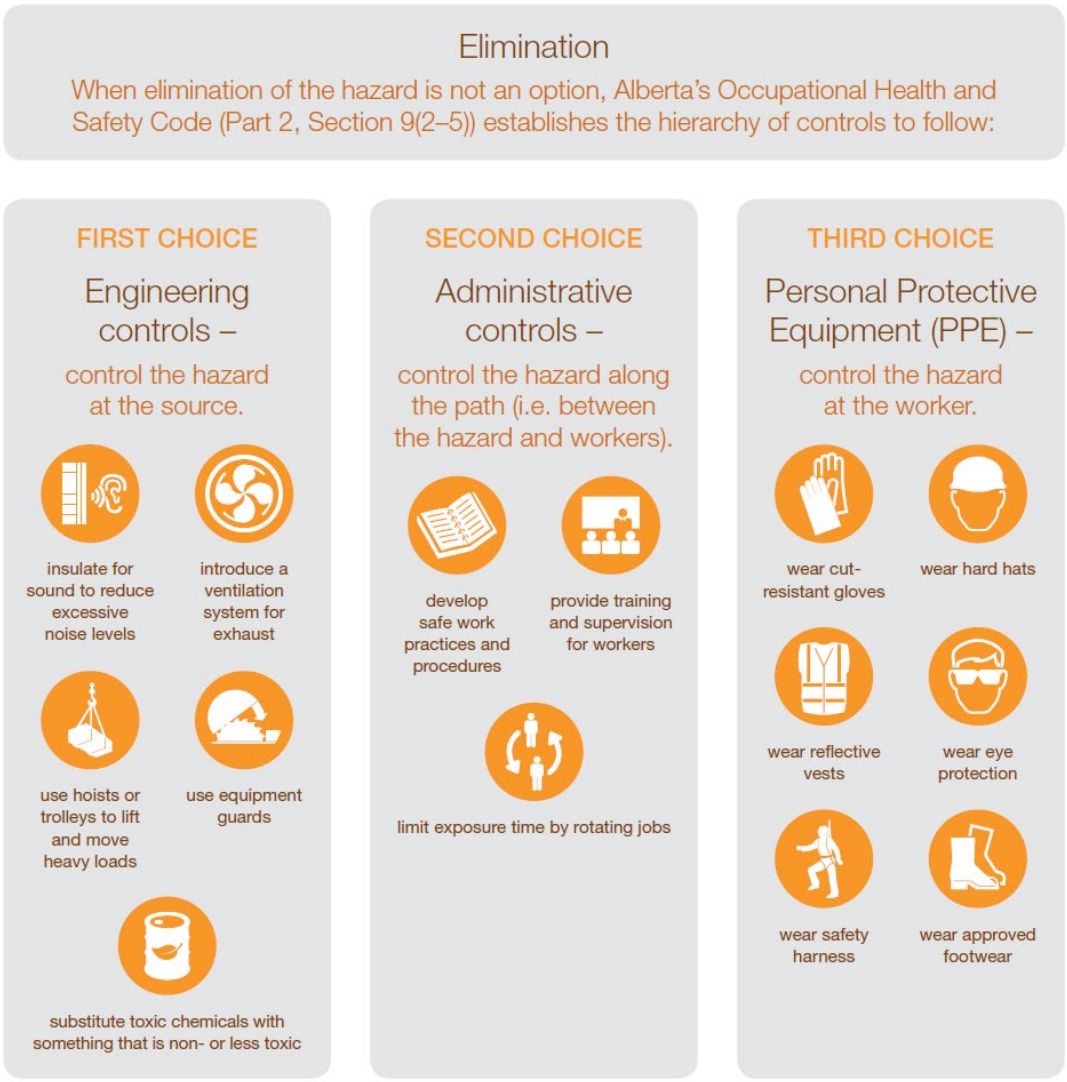
6.1.3 Hazard Communication

It is the joint responsibility of workers and work site supervisors to identify work site hazards. The purpose of hazard reporting is to alert workers and work site supervisors of any hazardous conditions that have been identified and the measures taken/controls to reduce risks associated with those hazards. Proper identification, assessment and control can be achieved through a combination of processes that includes, but is not limited to, the following:

- Formal hazard assessment and development of standard operating procedures;
- Job hazard analysis and development of site specific procedures (including critical task procedures commonly prepared for Pieridae owned and operated plant and equipment under the PEIM or PSLMS, and preventative maintenance procedures);
- Field level hazard assessment used to identify work site and job specific hazards on the day the job is being completed (typically completed by third-party contractors prior to beginning work);
- Safety meetings (pre-job, tail gate or toolbox meetings completed before work is completed with workers and supervisors);
- Safe work permit procedure (safe work permits are issued by Pieridae work site supervisors to third-party contractors);
- Hazard alert and near miss reporting (Refer to Section 6.1.8 Hazard Alert/Near Miss Reporting and Form 09 – Hazard Alert/Near Miss Report);
- Planned inspections (Refer to Section 7.0 Planned Inspections);
- Management of change process (Refer to Section 6.5 Management of Change).

6.1.4 Hierarchy of Controls

Once a hazard is identified, a hierarchy of controls can be applied and used including: elimination (or substitution); engineering controls; administrative controls (written procedures); and personal protective equipment (or a combination of engineering, administrative and PPE if there is a greater level of worker safety).



Reference: Excerpted from the Alberta Government, OHS Best Practices BP018.

6.1.5 Risk Assessment

Risk assessment is the overall process of hazard identification, risk analysis, and risk evaluation.

- Hazard identification - identifying hazards and risk factors that have the potential to cause harm. The process of finding, listing and characterizing hazards.
- Risk analysis - analyzing and evaluating the risk associated with the hazard. The process of comprehending the nature of hazards and determining the level of risk.
- Risk evaluation – the process of comparing an estimated risk against a given risk criteria to determine the significance of the risk.

After a risk assessment is completed, controls can be implemented. Controls

determine appropriate ways to eliminate the hazard or control the risk when the hazard cannot be eliminated (i.e. using the hierarchy of controls including meaning engineering, administrative, PPE or combination thereof).

Hazards can be categorized using a simple categorization of low, medium or high.

Alternatively, a risk matrix can also be used to assess and analyze risk. An example 4x4 risk matrix is provided below. To use the risk matrix, multiply the probability (horizontal x axis) x severity (vertical y axis) to identify the risk rating (origin).

Pre-Job Hazard Assessment – Risk Rating Guide risk rating = probability X severity				
4. Imminent Danger	4	8	12	16
3. Serious	3	6	9	12
2. Minor	2	4	6	8
1. Negligible	1	2	3	4
	1. Unlikely	2. Likely	3. Somewhat Probable	4. Probable
NO ACTION	*MONITOR*	*ACTION*	*URGENT ACTION*	*STOP*

- White (score of 1) – very low risk. Good to go to work (risk is 1 or “no action” or white).
- Green (score of 2 or 3) – Low risk. Work can proceed with monitoring.to go to work (risk is 2-3 and work can proceed with monitoring).
- Yellow (score 4-6) – High risk. Action is required before work can proceed. This may include lock out/tag out or other isolations; air monitoring; etc. Work should only proceed if there are specific controls in place.
- Orange (score of 8-12) – urgent action is required before work can proceed. This may include direct supervision/watchman; confined space entry; fall protection and/or other specific and direct controls.
- Red (score of 16) – STOP. Work may not proceed under any circumstances. Consult with work site supervisor immediately.

Once a risk is identified, alternatives should first be considered to eliminate the risk if possible, failing which, measures should be implemented to control and reduce the risk to an acceptable level. Work cannot proceed if it presents an unacceptable risk. Risks must be reduced to as low as reasonably practicable.

Other, more detailed risk assessment matrices may be used for hazard and operability studies, environment and public health risks, legal/financial and other risks, and reputational risk.

6.1.6 Formal Hazard Assessment and Development of Standard Operating Procedures

A formal hazard assessment is a broad view of overall operations to identify hazards, assess risk, and develop, implement and monitor related controls. A formal hazard assessment will be completed annually and is the basis of the health and safety management system that will be used to develop processes. A procedure is a specified way to carry out an activity or process. The standard operating procedures contained in this manual have been developed for hazardous jobs that have been identified as a priority and are common throughout the oil and gas industry, required by regulation and are confirmed applicable to the organization based on the annual formal hazard assessment. The formal hazard assessment must be dated, participants identified, and retained on file for period of three years.

Refer to Section 9.0 Standard Operating Procedures. The standard operating procedures are:

- Aircraft Safety;
- All Terrain Vehicles (ATV's);
- Atmospheric Testing;
- Building and Lease Entry;
- Confined Space Entry;
- Electrical Safety;
- Fire and Explosion Hazard Management;
- First Aid;
- Fit for Work – Fatigue Management;
- Fit for Work - Alcohol/Drug Procedure;
- Fit for Work - Mental Health in the Workplace;
- Ground Disturbance;
- Hand tools;
- Hot Work;
- Housekeeping;
- Hydrogen Sulphide (H_2S);
- Isolation (Lock out tag out);
- Lifting (Manual Lifting)
- Lifting and Towing Devices;

- Naturally Occurring Radioactive Materials (NORMs);
- Office Safety;
- Plant Installations;
- Pipeline Integrity;
- Safe Driving;
- Safety Device Bypassing;
- Security and Crime Prevention;
- Silica;
- Signs, Labels and Barricades;
- Tank Gauging;
- Truck Loading/Unloading;
- Welding;
- Wildlife Awareness;
- Working Alone;
- Working at Heights;
- Violence and Harassment Prevention.

6.1.7 Job Hazard Analysis and Site Specific Procedure Development

Proper work procedures are the safest way of doing a job, providing job instruction and monitoring performance.

Standard operating procedures have been developed various jobs. Refer to Section 9.0 Standard Operating Procedures. If a standard operating procedure is not in place, a job hazard analysis (JHA) can be conducted to facilitate preparation of a site specific procedure that is based on the JHA, regulations and specific operating conditions. The JHA includes an assessment of risk (probability + severity = low, medium, high). Refer to Section 6.1.5 Risk Assessment for a more comprehensive risk assessment. The JHA must be dated and the team that conducted the JHA must be listed.

Job hazard analysis (JHA) involves the following steps:

- Select the job;
- Break the job into a sequence of steps;
- Identify the hazards; and
- Define safe work practices including preventative measures.
- JHA's must be written, published and available to employees and regulators.

A JHA should be conducted on all critical tasks or jobs as a priority. JHA's should be updated periodically. Critical jobs generally include:

- Those required by other management systems (for example, the Pressure Equipment Integrity Management system) requires that critical tasks be identified, training be completed, and competency verified). Refer to other manuals i.e. PEIMS and PSLMS and Section 4.4 Production Operator Competency.
- Those where frequent incidents occur;
- Those where severe incidents or injuries occur;
- Those with potential for severe incidents or injuries;
- New or modified jobs; and
- Infrequently performed jobs.

JHA is generally carried out by observing a worker doing the job or by a worker who has completed the job. Refer to Appendix 1, Form 12 – Job Hazard Analysis. Once the JHA is completed it can be used to develop a site specific procedure. Refer to Appendix 1, Form 20 – Site Specific Procedure (template).

6.1.8 Hazard Alert/Near Miss Reporting

Certain circumstances may warrant the completion of a hazard alert/near miss report. Refer to Appendix 1, Form 09 – Hazard Alert/Near Miss Report. The hazard alert/near miss reporting procedure was developed to capture situations where an incident has not occurred but under slightly different circumstances could have resulted in unintended harm or damage.

The worker who observes the hazard should discuss the situation with co-workers as soon as possible. It is an opportunity to help prevent an incident. Hazards should also be discussed with the work site supervisor, and can also be discussed at scheduled or pre-job safety meetings. Refer to Section 12.0 Incident Reporting and Investigation for additional information.

Management strongly supports incident and hazard/near miss reporting and workers must understand that person(s) reporting will be granted immunity from disciplinary action.

6.2 Safe Work Permit

6.2.1 Introduction

All work exposes the worker to some degree of hazard. The use of a safe work permit assists in determining hazards and the types of safeguards required to protect the worker. A safe work permit is a document that identifies the work to be done, the hazard(s) involved and the precautions to be taken. It ensures that hazards and precautions have been methodically considered before work begins.

The safe work permit is the key document that will be used as a guide to ensure standard operating procedures are followed and supplemental permits are completed as required depending on the nature of the work.

- The safe work permit will be used for all jobs on Pieridae work sites involving contractors.
- The issuer of the safe work permit will, in-so-far as is practicably reasonable, inspect the operation to confirm if the isolation, lock out or testing has been done.
- The issuer will periodically inspect the operation after the work has begun.
- The worker will return the permit upon job completion or will call the permit issuer when the job is completed.
- Pieridae will audit and enforce the safe work permit procedure.

6.2.2 Training

The permit issuer will receive training via the orientation process. Refer to Section 4.2 Orientation (Section 4.2.1 Employee Orientation and Section 4.2.2 Work Site Supervisor HSE Package).

It is the responsibility of the hiring supervisor to communicate the requirement to issue safe work permits to contractors working on Pieridae work sites.

6.2.3 Drilling and Completions Work

Drilling and completions operations have unique circumstances and therefore have different requirements. Refer to Section 13.4.5 Drilling and Completion Site Safety Assessments.

6.2.4 Responsibilities

Issuer

- A safe work permit must be issued by a qualified person who is familiar with the work or situation covered by the safe work permit and who has control over changes in the work area (i.e. work site supervisor).
- The issuer must be sure that the work situation identified on the permit is as described. Where possible, the permit issuer should inspect the work or operation before work begins. If the permit issuer has not inspected the site, this should be noted on the permit and the work situation should be discussed with the worker.
- Any special precautions not normally associated with the particular work should be identified to the receiver of the permit, who must fully understand the reasons for these precautions (i.e. work to be done in an area where there is a possible exposure to H_2S gas).
- No one should sign a safe work permit unless completely satisfied that the work can be done safely.

Receiver

- The person receiving the permit must understand the work situation, the potential hazards and the precautions required before accepting the permit.
- No one should sign a safe work permit unless completely satisfied that the work can be done safely.

6.2.5 Using the Safe Work Permit Form

All work exposes the worker to some degree of hazard. The use of a safe work permit assists in determining hazards and the types of safeguards required to protect the worker(s). It ensures that hazards and controls are methodically considered before work begins and it is a legal document between the issuer and the receiver. The safe work permit helps to identify and control hazards, but does not, by itself, make the job safe. Refer to Appendix 1, Form 18 – Safe Work Permit.

The safe work permit is a valuable tool as it defines a methodical approach to communicating all aspects of the job to be performed. The safe work form identifies the following issues:

- The date, valid period and indication of whether the permit is a blanket permit.
- The contractor(s) or company(s) doing the work and the number of workers.
- Indication whether an orientation has been completed (i.e. using the Pieridae Contractor's HSE Orientation).
- Applicable LSD(s).
- Indication whether the work is hot work or cold work.
- A description of the work to be completed.
- A special instructions section that: directs the issuer to other permits that may be required depending on the nature of the job (e.g. confined space entry or ground disturbance); that a pre-job meeting is required; and a reminder that cellular phones and relay-activated horns must be turned off in hazardous areas.
- Indication of whether the work area has been inspected. The work site must be inspected for hot work. If the work site has not been inspected for cold work it must be explained. Added contractor FLHA requirement.
- A hazard identification section. This section lists possible hazards that may be involved with the work or in the work area including:
    - exposure to toxic atmospheres (H_2S); oxygen deficiency; flammable gases/liquids; energy/ignition source; oxygen/air; fire and explosion; limited access/egress; working at heights/falling; rotating equipment; pressurized equipment; excessive noise (greater than 85dB); electrical hazards; excavation/trenching; underground equipment/lines; overhead electrical lines; moving vehicles/equipment; fatigue; working alone; weather/road/lease conditions; housekeeping/lighting; extreme temperatures; exposure to hazardous materials (e.g. chemical exposure); radioactive/NORMs; and other.
- A hazard control section. This section considers the hazards and presents various methods to control and/or reduce the identified hazards including:
    - **PPE** - The need for standard personal protective equipment (hard hat, fire retardant coveralls, steel toed footwear, and safety glasses) and other specific

personal protective equipment such as: hearing protection, safety harness, life line, fall protection, personal monitor, respiratory equipment, SCBA/SABA equipment. Reference to SDS that may be applicable.

- **Safety equipment** - The need for safety equipment such as: barricades, warning signs, additional fire equipment, WHMIS/TDG compliance, waste streams managed, watch person, and other.
- **Ventilation** - The need for ventilation such as: air, steam, inert gas purge, water flood or other.
- **Isolation** - The need for electrical or mechanical isolation. Indication of isolation methods such as: locked or tagged, blinded or blanked, cathodic protection off, disconnected, depressured, drained, vented, drains/sumps covered and sealed, equipment grounded, and emergency systems bypassed.
- **Atmospheric testing** – Atmospheric testing must be completed prior to conducting hot work and it must be indicated who did the testing and the initial readings of: oxygen (19.5-23% is acceptable), LEL% (must not exceed 20% of LEL) and H_2S (if applicable, must not exceed 10ppm). The need for continuous monitoring and/or testing must be indicated. The need for a watch person must be indicated. The environmental conditions must be indicated.

- In addition to the checkbox format hazard and control section, additional room to write other hazards and controls that may not be addressed by the checkbox format. This section allows permit issuers to write additional and unique information that may apply to a particular job or task.
- An emergency procedures and incident reporting section including: a reminder that emergency procedures must be reviewed; identification of a muster area; and indication of whether cellular communication is possible.
- An agreement section (a safe work permit is a legal document) including names and phone numbers of the issuer and receiver(s) including signatures.
- A permit renewal or revalidation section (which should be used if any of the conditions occur to void the permit or require revalidation of the permit).
- A permit close out/work complete checkbox. As a minimum, the permit issuer should obtain verbal confirmation when the contractor has completed the job.

6.2.6 Safe Work Permit Validation and Blanket Permits

- Safe work permits are valid for the duration stated on the permit or until there is a shift/crew change.
- The safe work permit may be revalidated to extend its duration beyond the original duration or to cover the on-coming shift/crew.
- Before a safe work permit can be revalidated, a site inspection should occur.
- If an emergency occurs or an alarm sounds all permits are automatically suspended and should be revalidated.
- Blanket permits are an exception, as they can be valid for up to 90 days or the duration of a specific job. Blanket permits may be issued for the following:
  - Certain contractor jobs within a production area as approved by the work site supervisor (i.e. fluid hauling, road maintenance).
  - Civil construction projects where the scope does not change providing a safety meeting and/or contractor meeting is conducted each day.

- Pipeline construction outside existing production facilities providing a safety meeting and/or contractor meeting is conducted each day.

6.2.7 Record Retention and Reporting

- A copy of the completed safe work permit is to be displayed at the work site or made readily available so that all site workers are aware of its location to ensure workers on the site know who is in control of the site.
- Files of completed safe work permits shall be maintained at the field office for a period of one year. If a reportable incident should occur on a permitted project, the safe work permit should be filed with the incident report.

6.3 Supervisory Control

6.3.1 Introduction

When work is completed on an Pieridae work site, Pieridae is the prime contractor unless specified in a written agreement. Refer to Section 8.2 Prime Contractor Designation and Responsibilities.

The Pieridae representative who directs work at the site on behalf of Pieridae is the work site supervisor. This person can be an employee, a contractor (i.e. such as a contract operator) or a construction, drilling, completions, pipeline or facility consultant and these individuals have all the responsibilities defined in this HSE Program as the work site supervisor. Refer to Section 4.2.2 Work Site Supervisor HSE Package.

6.3.2 Simultaneous Operations (SIMOPS)

In cases where there is more than one operation occurring on a site at any one given time it is important that the work site supervisors work together to ensure the health and safety of everyone working on site. This is achieved, in part, through the use of a simultaneous operations or SIMOPS form. Refer to Appendix 1, Form 18a - SIMOPS Form.

The simultaneous operations form identifies the single point of authority (SPA) for the operations that may be conducted on the site including completions, operations and facilities. Each SPA is the work site supervisor for operations that are being directed by that work site supervisor and as such are responsible to issue safe work permits to contractors as per normal. The SIMOPS form ensures that the planned activities and simultaneous operations risks are clearly identified and that specific mitigation controls are in place (e.g. such as a safe work area, gas detection and communication via a hazard board in a control center and/or operations trailer).

The SIMOPS form also provides for delegation of a single point of authority for a specific time period in the event that a work site supervisor is not on the location. The form further requires that the various SPA's communicate to on site workers

under their supervision the nature of the simultaneous operations and the hazards and mitigation measures in place.

6.3.3 Handover

Communication is required when site operations are transferred from one operations department to another (e.g. production operations to drilling) or for change in operatorship. The formal (i.e. written method) of assigning or transferring supervisory control is to complete a handover form. Refer to Appendix 1, Form 18b – Handover Form.

The purpose of the handover form is to clearly communicate who is handing over a site and to whom the site is being handed over and any actions that may be required to ensure safety and compliance at the work site.

6.4 Safety Meetings

6.4.1 Introduction

Safety meetings provide an opportunity to effectively share information. Effective safety meetings:

- Demonstrate a commitment to safety;
- Increase overall safety awareness;
- Communicate hazards and discuss safety issues related to the job at the time work is being done;
- Solicit feedback on safety matters; and
- Provide training in safety procedures.

There are primarily two types of safety meetings: pre-job safety meeting and scheduled safety meetings. However, safety issues can be brought forth at any meeting.

6.4.2 Responsibilities

Work Site Supervisors

- Will ensure safety meetings are held.
- Will document safety meetings (either through issuance of a safe work permit, pre-job safety meeting form, or signing on to a contractor field level hazard assessment such as a “pre-job meeting”, “tailgate safety meeting”, or “job hazard analysis/job safety analysis).
- Will ensure significant safety conditions and concerns identified during meetings are corrected prior to initiating work or by a specific date.
- Communicate significant safety issues to management.

Designated Meeting Chairman

- Will prepare, conduct and follow-up as required for safety meetings.

Workers

- Will actively participate in safety meetings.

6.4.3 Pre-Job Safety Meetings

These meetings are held at the beginning of a new or unfamiliar job, or prior to commencing potentially hazardous work and must be documented on a safe work permit, or a contractor job hazard analysis/tail gate safety meeting or equivalent, or using an actual pre-job safety meeting form. Pieridae expects a safety meeting to be conducted each day before work begins or prior to commencing potentially hazardous work.

- A pre-job safety meeting is part of the safe work permitting procedure and is documented on the safe work permit form.
- In many cases a contractor will host and document a safety meeting. If this is the case, the work site supervisor should attend the meeting and obtain documentation of the meeting for file and include reference to the meeting on any reports to the Calgary office.
- In some cases (i.e. large construction projects) a formalized pre-job safety meeting should be held with the contractor, engineering representatives, area operations personnel and safety representatives. For this type of meeting an agenda should be prepared and meeting minutes documented.

If the Pieridae work site supervisor chairs the meeting the following shall be completed:

- Include workers involved with the job;
- Discuss the work and any site specific hazards, emergency procedures, safety precautions and other topics related to the job (the safe work permit can be used as a guideline for discussion topics).
- Document the meeting.

6.4.4 Scheduled Safety Meetings

These meetings are intended for production operations. Scheduled safety meetings will be held at Pieridae production operation work sites on a regular basis. Meetings should be scheduled at the beginning of each year with consideration for shift schedules.

- Core operating areas should have monthly safety meetings.
- Non-core areas may have meetings on a regularly scheduled basis.

Topics can include anything relevant to worker HSE and should be tailored to the specific needs of the work site. Outside speakers or trainers may be invited to provide specific information.

There are generally three phases to a monthly safety meeting: prepare for the meeting; conduct the meeting including a sign in sheet and meeting minutes; and follow up to ensure action items are addressed.

Scheduled Safety Meeting Minutes

The purpose of the safety meeting minutes form is to provide structure for conducting effective meetings. Refer to Appendix 1, Form 19 – Safety Meeting Minutes. In general, safety meetings should follow this structure:

- Document meeting attendees (sign in sheet).
- Review old business.
- Discuss new business.
- Review incident reports.
- Discuss a specific safety meeting topic. Suggested references and ideas for the preparation of safety meeting topics include: review a (M)SDS sheet for a chemical that is used at the work site; or review a safe work permit that was used for a particular job.
- Review a section of the HSE Program. Prepare audiovisual materials if possible to support the topic.
- Review the monthly HSE Report.
- Open the floor to new business (i.e. go around the room and ask each individual for a new business item).
- Document each new issue and assign a person and a target date that is agreed to by the team for each new issue.
- Upon meeting completion, prepare meeting minutes and distribute accordingly.

6.5 Management of Change

6.5.1 Refer to the Pieridae Quality Assurance Manual (Pressure Equipment Integrity Management)

Proper management of change to pipelines and plant processes is recognized as critical to safety, since complex processes can be sensitive to small changes which could have the potential to cause injuries, equipment damage and loss of revenue.

6.6 Chemical Exposure/Workplace Hazardous Materials Information System (WHMIS)

6.6.1 Introduction

Exposure to chemical or biological substances in the workplace may be harmful to worker safety and health and is a hazard. Workers may have to use, produce, store, handle and dispose of chemical substance (any natural or artificial substance, whether in the form of a solid, liquid, gas or vapor, other than a biological substance) or biological substance (any substance containing living organisms or parts of living organisms in natural or modified forms) in the

workplace. Some work sites may only have a few chemical or biological substances to consider and others may have many. It is important for workers to know the hazards of chemicals and appropriate precautions to take to work safely and avoid injury. Pieridae is responsible to ensure that a worker's exposure to any substance listed in provincial regulations is kept as low as reasonably achievable.

Refer to provincial OHS regulations for chemicals and exposure limits.

Workplace Hazardous Materials Information System (WHMIS) is a comprehensive plan for providing information on the safe use of hazardous products at the workplace.

This section will cover:

- Definitions;
- Responsibilities;
- Training and instruction;
- Chemical inventory procedure;
- Classification of hazardous products;
- WHMIS labelling (supplier and workplace labels)
- Safety data sheets (SDS);
- Pieridae produced products;
- Personal protective equipment.

6.6.2 Definitions

In general, the **occupational exposure limit (OEL)** represents the maximum airborne concentration of a toxic substance to which a worker can be exposed over a period of time without suffering any harmful consequences.

- 8-hour occupational exposure limit
- 15-minute or ceiling occupational limit

These limits are set out by many professional organizations around the world, such as the American Conference of Governmental Industrial Hygienists (ACGIH), and the National Institute for Occupational Safety and Health (NIOSH) in the United States. They are established based on the chemical properties of the substance, experimental studies on animals and humans, toxicological and epidemiological data. Different organizations may use different terminology for the OEL. For example, the ACGIH term for OEL is "Threshold Limit Value" (TLV)® while the NIOSH term is "recommended exposure limits" (REL).

ACGIH defines three categories of "Threshold Limit Value" TLVs®:

Threshold Limit Value – Time-Weighted Average (TLV-TWA): The concentration of a hazardous substance in the air averaged over an 8-hour

workday and a 40-hour workweek to which it is believed that workers may be repeatedly exposed, day after day, for a working lifetime without adverse effects.

Threshold Limit Value – Short-term exposure (TLV-STEL): A 15-minute time weighted average exposure that should not be exceeded at any time during a workday, even if the overall 8-hour TLV-TWA is below the TLV-TWA. Workers should not be exposed more than four times per day to concentrations between TLV-TWA and TLV-STEL. There should be at least a 60 minute interval between exposures. The short-term exposure threshold has been adopted to account for the acute effects of substances that have primarily chronic affects.

Threshold Limit Value – Ceiling (TLV-C): This is the concentration that should not be exceeded during any part of the working exposure. Peak exposures should be always controlled. For substances that do not have TLV-TWA or TLV-C established, the maximum admissible peak concentrations must not exceed:

- Three-times the value of the TLV-TWA for no more than 15 minutes, no more than four times per workday. Exposures must be at least 1 hour apart during the workday.
- Five times the TLV-TWA under any circumstances.

The units of measures for the threshold limit values are ppm and mg/m^3. The TLVs for aerosols are expressed usually in mg/m^3. The TLVs for gases and vapours are expressed in ppm or mg/m^3.

Occupational Hygiene - Occupational hygiene is the branch of occupational health and safety which focuses on the prevention of the occupational diseases. The exposure to health hazards can lead to diseases and illnesses that can manifest either immediately or after a long period of time after the exposure has stopped. Since these diseases are a consequence of exposure to hazards present in the work place, they are known as occupational diseases. Occupational hygiene uses methods for exposure identification and evaluation following the techniques of anticipation, identification, evaluation, and control. The goal is to identify solutions for eliminating or reducing the hazard and monitoring to ensure no further harm occurs. Occupational exposure limits are one tool or method in this process.

6.6.3 Responsibilities

Suppliers, employers and workers all have specified responsibilities under WHMIS.

Suppliers - Suppliers are those who sell or import products. When this product is considered a hazardous product according to the WHMIS legislation, a supplier must label the product or container, and provide a (M)SDS sheet to the customers. The purpose of the labels is to clearly identify the contents of the hazardous material, and the (M)SDS is to explain what those hazards are.

Employers - Employers are required to establish education and training programs for workers exposed to hazardous products in the workplace. Employers must

also make sure that the products are labeled and that an (M)SDS is present for each product that is readily available to workers.

Workers - Workers are required to participate in the training programs and to use the information to work safely with hazardous materials. Workers must also inform employers when labels on containers have been accidentally removed or if the label is no longer legible.

6.6.4 Training and Instruction

Pieridae requires that employees directly involved with field operations receive and maintain WHMIS training and certification. Workers who may have to use, produce, store, handle and dispose of chemical or biological substance in the workplace must be trained in WHMIS and also know how to access Pieridae's area specific SDS repository. Refer to Section 4.5.2 Workplace Hazardous Information System (WHMIS).

All employees must be trained in WHMIS, with emphasis on the hazardous substances that they will be using at the work site. Employees need to know the following:

- Understand what WHMIS is/means;
- Understand how to use labels and (M)SDS sheets;
- Know the location of the (M)SDS sheets for hazardous materials located at the work site;
- Know the procedures to be followed if there are fugitive emissions;
- Know the procedures to be followed in case of an emergency involving hazardous materials; and
- Know how to safely handle, use, store and dispose of hazardous materials on a day-to-day basis.

During the transition from WHMIS 1988 to WHMIS 2015, employers are required to educate and train workers on the version(s) of WHMIS used in the workplace.

- If there are no products with WHMIS 2015 SDSs and labels in the workplace, an employer continues to educate workers on the WHMIS 1988 system.
- If an employer receives a product that has an SDS and label complying with WHMIS 2015, the employer must comply with the new requirements, including revised education and training on: new hazard classes, pictograms, and labels; required elements such as signal words; the meaning of all signal words and hazard statements found on labels and SDSs in the workplace; and the new SDS format and how to locate information needed to work safely with a product.
- If there are both products with WHMIS 1988 MSDSs and labels and products with WHMIS 2015 SDSs and labels in the workplace, an employer must educate workers about both systems.

6.6.5 Chemical Inventory Procedure

The following procedure has been provided as a guideline for work sites to identify chemical substances that may be present on the work site.

- Determine which chemical or biological substances in the workplace present a risk to workers.
- Obtain and review the SDS for each substance. Evaluate the hazard for each substance. Information can be determined for health issues, fire and explosive hazards or corrosive hazards to eyes and skin. If a hazardous product is poisonous or infectious, pay particular attention to toxicological properties. Toxicological properties for some substances can be complicated and support from industrial hygienists may help with decision-making. SDS information covers both acute and chronic exposures.
- Use safe work procedures for each chemical or biological substance that presents a risk.
- Determine if the risk is from a non-airborne (i.e. direct contact to skin, eyes, mucous membranes) or airborne (inhalation) exposure.
- If exposure is not airborne, immediately apply control measures to eliminate the risk.
- If the exposure is airborne, establish an appropriate occupational exposure limit (OEL).
- Monitor airborne exposures to chemical or biological substances.
- If the workplace assessment or monitoring indicates that workers are exposed to a chemical or biological substance in excess of the OEL, apply control measures to reduce exposure and meet the OEL.
- Make sure control measures ensure worker exposures do not exceed the OEL.
- Reassess risk of exposure to workers when there is new information on the toxicity of a chemical or biological substance, or when workplace conditions change.

Once the chemical hazards, biological hazards, and harmful substances are known, worker exposure to substances listed in provincial OHS legislation (e.g. Alberta Schedule 1, Table 2) to any listed substances must be kept as low as reasonably achievable. A worker's exposure limit to any substance listed in provincial OHS legislation must not exceed its occupational exposure limits. If no occupational exposure limit is established for a harmful substance present at a work site, exposed worker's exposure is to be kept as low as reasonably achievable. A worker may not be exposed to a substance listed at a concentration exceeding its celling limit at any time. Refer to provincial regulations.

6.6.6 Classification of Hazardous Products

Under WHMIS 2015, hazardous products are divided into two hazard groups:

- Physical hazards, based on the physical or chemical properties of the product, such as flammability, reactivity, or corrosivity to metals.
- Health hazards, based on the ability of the product to cause a health effect,

such as: eye irritation; respiratory sensitization (may cause allergy or asthma symptoms, or breathing difficulties; and carcinogenicity (may cause cancer).

The two hazard groups are further divided into hazard classes and categories. Each hazard class contains at least one category. The hazard categories are assigned a number (1,2, etc.) or may be called types and assigned an alphabetic letter (A, B, etc.). In some cases, subcategories are specified as identified by a number and a letter (i.e. 1A and 1B).

The category identifies how hazardous the product is (that is, the severity of hazard).

- Category 1 is always the greatest level of hazard (that is, it is the most hazardous within that class). If Category 1 is further divided, Category 1A within the same hazard class is a greater hazard than category 1B.
- Category 2 within the same hazard class is more hazardous than category 3, and so on.

Pictograms are assigned to specific hazard classes or categories to immediately show the type of hazard a hazardous product presents and are included on labels and safety data sheets. Most pictograms have a distinctive red, diamond-shaped border. Inside this border is a symbol that represents the potential hazard. See the table below.

Pictogram	Name (hazard description)	Associated classes and categories
	Flame (for fire hazards)	• Flammable gases (Category 1) • Flammable aerosols (Category 1 and 2) • Flammable liquids (Category 1, 2, and 3) • Flammable solids (Category 1 and 2) • Pyrophoric liquids (Category 1) • Pyrophoric solids (Category 1) • Self-heating substances and mixtures (Category 1 and 2) • Substances and mixtures which, in contact with water, emit flammable gases (Category 1, 2, and 3) • Self-reactive substances and mixtures (Types B*, C, D, E, and F) • Organic peroxides (Types B*, C, D, E, and F)
	Flame over circle (for oxidizing hazards)	• Oxidizing gases (Category 1) • Oxidizing liquids (Category 1, 2, and 3) • Oxidizing solids (Category 1, 2, and 3)

	Gas cylinder (for gases under pressure)	• Gases under pressure (Compressed gas, Liquefied gas, Refrigerated liquefied gas, and Dissolved gas)
	Corrosion (for corrosive damage to metals, as well as skin, eyes)	• Corrosive to metals (Category 1) • Skin corrosion/irritation – skin corrosion (Category 1, 1A, 1B, and 1C) • Serious eye damage/eye irritation – Serious eye damage (Category 1)
	Exploding bomb (for explosion or reactivity hazards)	• Self-reactive substances and mixtures (Types A and B*) • Organic peroxides (Types A and B*)
	Skull and crossbones (can cause death or toxicity with short exposure to small amounts)	• Acute toxicity: - Oral (Category 1, 2, and 3) - Dermal (Category 1, 2, and 3) - Inhalation (Category 1, 2, and 3)
	Health hazard (may cause or suspected of causing serious health effects)	• Respiratory or skin sensitization – Respiratory sensitizer (Category 1, 1A, and 1B) • Germ cell mutagenicity (Category 1, 1A, 1B, and 2) • Carcinogenicity (Category 1, 1A, 1B and 2) • Reproductive toxicity (Category 1, 1A, 1B, and 2) • Specific target organ toxicity – Single exposure (Category 1 and 2) • Specific target organ toxicity – Repeated exposure (Category 1 and 2) • Aspiration hazard (Category 1)
	Exclamation mark (may cause less serious health effects or damage the ozone layer)	• Acute toxicity – Oral, Dermal, Inhalation (Category 4) • Skin corrosion/irritation – Skin irritation (Category 2) • Serious eye damage/eye irritation – Eye irritation (Category 2 and 2A) • Respiratory or skin sensitization – Skin sensitizer (Category 1, 1A, and 1B) • Specific target organ toxicity – Single exposure (Category 3)
	Biohazardous infectious materials (for organisms or toxins that can cause diseases in people or animals)	• Biohazardous infectious materials (Category 1)
No Pictogram Required		• Flammable gases – Category 2 • Flammable liquids – Category 4

		• Self-reactive substances and mixtures – Type G • Organic peroxides – Type G • Combustible dusts – Category 1 • Simple asphyxiants – Category 1 • Serious eye damage/eye irritation – Eye irritation – Category 2B • Reproductive toxicity – Effects on or via lactation

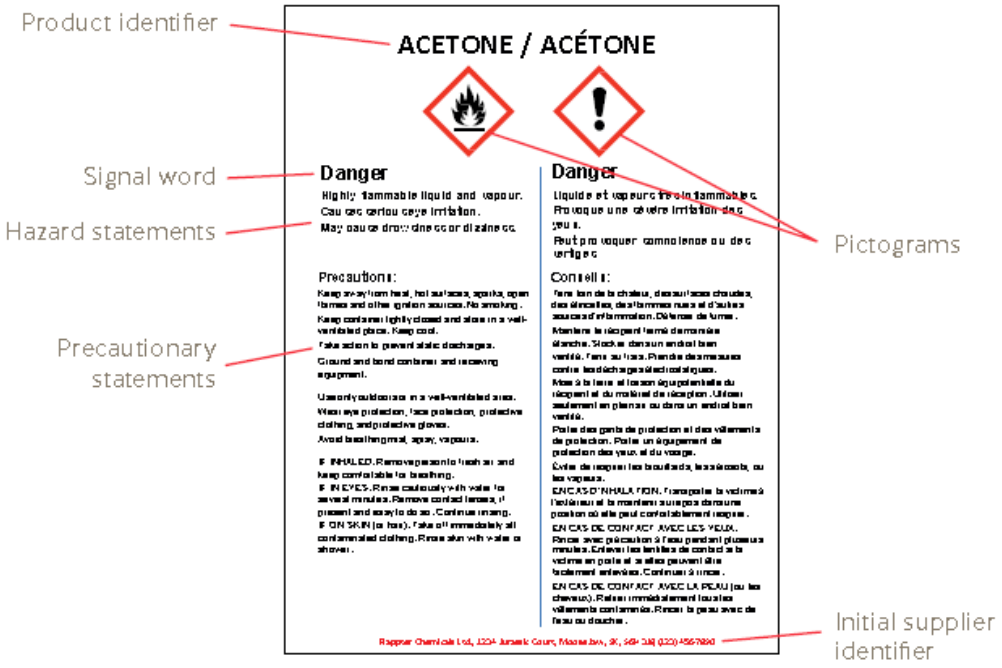
* Both the Flame and Explosive pictogram are used for Self-reactive substances and mixtures (Type B) and Organic peroxides (Type B)

NOTE: Physical Hazards Not Otherwise Classified and Health Hazards Not Otherwise Classified classes are required to have a GHS pictogram that is appropriate to the hazard identified.

6.6.7 WHMIS 2015 Labeling

All hazardous products on the work site must be labeled. Labels are of two basic types: a supplier label or a workplace label (alternate labeling systems may also be permitted).

Supplier Labels - provided or affixed by the supplier of the hazardous product. Supplier labels will appear on all hazardous products received at a workplace. If a hazardous product is always used in its original container with a supplier label, no other label is required. Supplier labels are required to be in both English and French and must include the following information:



Workplace Labels - required when any of the following apply: a hazardous product is produced (made) at the workplace and used in that workplace; a hazardous product is decanted (for example, transferred or poured) into another container; and a supplier label becomes lost or illegible. A workplace label is not required when a hazardous product is poured into a container to be used immediately or when it is under control of the person who decanted it.

Alternate Labeling Systems - Variations to WHMIS labels (i.e. mark, sign, stamp, sticker, seal, ticket, tag, or wrapper) may be allowed for specific items such as: bulk shipments; Small capacity containers 100 mL or less; small capacity containers 3 mL or less; piping systems and vessels. Workers must be trained to be able to identify these alternate systems if they are used in the workplace.

6.6.8 WHMIS 2015 Safety Data Sheets or SDS

Every product that is classified as a hazardous product under WHMIS legislation must have a SDS. SDSs are summary documents that provide information about hazardous products and advice about safety precautions. SDS provide more detail than labels. SDSs for all hazardous products at the work site must be retained and accessible to everyone at the work site (may be computerized).

SDSs are written and provided by the manufacturer or supplier of the product. In some cases, an employer may be required to prepare an SDS, such as for products that are produced and used exclusively in that workplace.

Every SDS will include a date of last revision. SDSs are required to be updated within 90 days of the supplier becoming aware of any significant new data, meaning when there is new information that changes how the hazardous product is classified, or there are changes to the way you should handle or store the product, or the way you should protect yourself from the hazards of the product (i.e. there is not a requirement to update a SDS every three years, as was the case for MSDS's under WHMIS 1988).

SDS address the following 16 topics (those marked with an asterisk* are optional, however the headings are required to be present).

- Identification - Product identifier, recommend use and restrictions on use, supplier contact information, emergency phone number.
- Hazard identification - Classification (hazard class and category), label

elements (including pictogram, signal word, hazard statements, and precautionary statements), and other hazards (i.e. thermal hazards).

- Composition/information on ingredients – for a hazardous product that is a substance: the chemical name, synonyms, CAS No., and the chemical name of impurities, stabilizing solvents, and stabilizing additives where classified and that contribute to the classification of the product. For a hazardous product that is a mixture: for ingredients that present a health hazard, the chemical name, synonyms, CAS No., and concentration. "Generic chemical identity" may be listed when the supplier has been approved by Health Canada to have the exact ingredients in the hazardous considered as confidential business information.
- First aid measures – First aid measure by route of exposure (inhalation, skin contact, etc.) as well as most important symptoms/effects.
- Firefighting measures – suitable (and unsuitable) extinguishing media, specific hazards, special equipment and precautions for firefighters.
- Accidental release measures – PPE, emergency procedures, methods and materials for containment and clean up.
- Handling and storage – precautions for safe handling, conditions for storage, including any incompatibilities.
- Exposure controls/personal protection – exposure limits, engineering controls, PPE.
- Physical and chemical properties - Appearance, odor, odor threshold, pH, melting/freezing point, boiling point and range, flash point, upper and lower flammable or explosive limits.
- Stability and reactivity - Reactivity, chemical stability, possible hazardous reactions, conditions to avoid, incompatible materials, hazardous decomposition products.
- Toxicological information - Description of various toxic effects by route of entry, including effects of acute or chronic exposure, carcinogenicity, reproductive effects, respiratory sensitization.
- Ecological information* - aquatic and terrestrial toxicity (if available), persistence and degradability, bioaccumulative potential, mobility in soil.
- Disposal considerations* - safe handling and methods of disposal, including contaminated packaging.
- Transport information* - UN number and proper shipping name, hazard classes, packing group.
- Regulation information* - safety, health and environmental regulations specific to the product.
- Other information* - Other information, including the date of the latest revision of the SDS.

6.7 Transportation of Dangerous Goods (TDG)

6.7.1 Introduction

The TDG Act and Regulations govern the transporting, offering for transport and handling of dangerous goods. The purpose is to protect the public when dangerous goods are being transported by road, rail, sea or air. The regulations have been written to ensure that the proper information is provided to anyone who handles, offers for transport or transports dangerous goods, as well as, to people who respond to emergencies involving dangerous goods.

Dangerous goods are separated into 9 classes and most classes are further separated into divisions according to the type or degree of danger involved. The classes include:

Class 1 – Explosives;

Class 2 – Gases;

Class 3 – Flammable Liquids;

Class 4 – Flammable Substances;

Class 5 – Oxidizers/Organic Peroxides;

Class 6 – Toxic/Infectious Substances;

Class 7 – Radioactives;

Class 8 – Corrosives; and

Class 9 – Miscellaneous.

This section will cover:

- Responsibilities;
- Training;
- Classification;
- Safety marks; and
- Dangerous occurrences.

6.7.2 Responsibilities

Consignors, carriers and receivers all have responsibilities under the Transportation of Dangerous Goods Act and Regulations.

Consignor (Shipper)

- Ensure that the goods are classified, packaged, marked, labeled and documented in accordance with regulations;
- Provide a copy of the shipping document;
- Ensure that placards are on the vehicle if required;
- Report any dangerous occurrences which occur during loading; and

- Keep a copy of the shipping document for two years.

Carrier (Driver)

- Check the shipment before accepting it;
- Attach placards, if required;
- Maintain or replace safety marks, if necessary;
- Carry and deliver shipping documents with the goods;
- Properly stow and secure the dangerous goods in the vehicle;
- Report any dangerous occurrences which occur during transport; and
- Keep a copy of the shipping document for two years.

Consignee (Receiver)

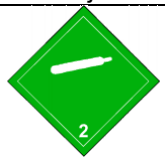
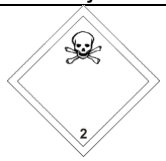
- Report any dangerous occurrences which occur during unloading,
- Keep a copy of the shipping document for two years.

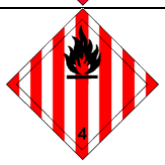
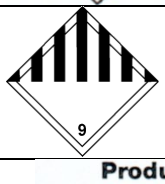
6.7.3 Training

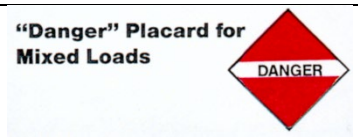
Any person who handles, transports, or offers for transport dangerous goods, must receive training and maintain certification. The certificate must be carried at all times and produced if requested by a Dangerous Goods Inspector. Refer to Section 4.5.3 Transportation of Dangerous Goods (TDG).

6.7.4 Safety Marks and Classes

Dangerous goods are separated into nine classes depending on the danger they present:

Class 1 – Explosives	 1.1 Major Explosion	 1.2 Major Projection	 1.3 Major Fire
Class 2 – Gases	 2.1 Flammable Gas	 2.2 Non-Flammable, Non Toxic Gas	 2.3 Toxic Gas
			

Class 3 – Flammable Liquids			
Class 4 – Flammable Substances	 4.1 Flammable Solid	 4.2 Spontaneously Combustible	 4.3 Dangerous When Wet
Class 5 – Oxidizers/Organic Peroxides	 5.1 Oxidizers	 5.2 Organic Peroxides	
Class 6 – Toxic/Infections Substances	 6.1 Toxic	 6.2 Infectious (Label)	 6.3 Infectious (Placard)
Class 7 – Radioactives			
			
Class 8 – Corrosives			
Class 9 – Miscellaneous			
	Product Identification Number (PIN) on the placard **or** on an orange panel near the placard. 		



6.7.5 Safety Marks (Labels, Placards & Exemption Permits)

Safety marks include labels, placards and documentation.

Labels - TDG labels are small diamond shaped safety marks used on small containers such as boxes, crates, or barrels. Labels must be placed where they are visible during transport. Both the shipping name and the Product Identification Number (P.I.N.) must be printed on the outside of every package or small container of dangerous goods. Containers that are WHMIS labeled must also have TDG labels if they contain dangerous goods and are to be transported.

Placards – TDG placards are large diamond shaped safety marks used generally on larger containers and are required for vehicles carrying more than 500 kg gross quantity of most dangerous goods, dangerous goods carried in bulk and large containers that have been emptied but not cleaned or purged. Placards are extremely important in providing information to emergency response personnel. Placards must be attached to all four sides of the vehicle so that at least one placard is visible from any direction.

Exemption Permits - Placards are generally not required for the types of dangerous goods carried in small quantities by field operations vehicles. Permits for equivalent level of safety provide variation to rules. However, if permits are not carried in the vehicle then placards must be used when applicable.

6.7.6 TDG Documentation

Every shipment of dangerous goods must be accompanied by a shipping document or a permit, unless exempt under the regulations. The document can be any form of trucking company waybill, trip ticket or manifest. The document must be prepared by the shipper and must show the following:

- Document number;
- Date;
- Signature of the shipper;
- Shipper's name and address;
- Receiver's name and address;
- Carrier's name;
- A description of the dangerous goods in the following order: shipping name, primary classification, P.I.N. and packing group; and

- The document must also indicate the total mass or volume of the dangerous goods including the number of packages, a 24-hour contact number, and the type and number of placards, if required.

When shipping certain types and quantities of dangerous goods an Emergency Assistance Response Plan (ERAP) number must be on the shipping document. ERAP's are required for facilities that offer NGLs for shipment. Membership in the Propane Gas Association provides membership in the emergency response association (i.e. similar to WCSS oil spill co-operative membership).

6.7.7 TDG Emergency Reporting

Federal TDG regulations regulate the transportation of dangerous goods for the road, rail, air and marine transport modes. The purpose of TDG legislation is to reduce the risk to emergency personnel, the public and the environment.

Any person who has the charge, management or control of a means of containment shall report a TDG emergency. Refer to Section 12.3.5 Alberta TDG and 12.3.8 BC TDG.

Pieridae workers involved with a TDG emergency should report to the supervisor and the ERP will be activated accordingly.

- In Alberta, TDG emergencies must be reported to: 911 (or local police) and Alberta Transportation, Dangerous Goods and Rail Safety (1-800-272-9600).
- In BC, TDG emergencies must be reported to: 911 (or local polices) and Provincial Emergency Program (1-800-663-3456) or Canadian Coast Guard (1-800-889-8852).

Report an emergency incident when:

- The release or anticipated release exceeds the reporting quantity in the table AND endangers, or could endanger, public safety.

In addition, if the incident involves:

- Death or injury requiring medical treatment;
- Evacuation or shelter-in-place of people;
- Closure of a loading/unloading facility;
- Closure of a road, rail line or waterway; or
- Major damage to the means of containment.

Then the emergency must ALSO be reported to CANUTEC (Canadian Transport Emergency Centre) and the consignor must be called.

If radioactive materials (Class 7) are involved, contact the Canadian Nuclear Safety Commission.

6.7.8 TDG Reporting Quantities Table

Class	Packing Group or Category	Quantity
1	II	Any quantity
2	Not applicable	Any quantity
3, 4, 5, 6.1, 8	I or II	Any quantity
3, 4, 5, 6.1, 8	III	30 L or 30 kg
6.2	A or B	Any quantity
7	Not applicable	A level of ionizing radiation greater than the level established in section 39 or the "Packaging and Transport of Nuclear Substances regulations, 2015"
9	I, II or without a packing group	30 L or 30 kg

Reference: SOR/2016-95

6.7.9 30-Day Follow Up Report

In the case that Pieridae would have to report a release or anticipated release report detailed above must make a follow-up report in writing to the Director General within 30 days after the day on which the report was made. There are specific information requirements that must be included in these types of reports.

6.7.10 Emergency Preparedness (ERAP and E2)

An Emergency Response Assistance Plan (ERAP) is required if a company offers NGLs for transport. Membership in the Propane Gas Association provides membership to the emergency response association (i.e. similar to WCSS oil spill co-operative membership).

An E2 plan is required if quantities of NGL greater than 4.5 tonnes are stored at a location.

Both the ERAP and E2 plans are federal requirements and should supplement the corporate and specific ERPs, as required.

Section 7.0

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7.0 PLANNED INSPECTIONS

7.1 Introduction

Planned inspections document conditions, ensure compliance and identify hazards. Inspections also provide a mechanism to evaluate Pieridae's HSE Program effectiveness and an opportunity to communicate HSE issues. Non-compliance issues, hazards or concerns identified during inspections must be addressed. To make the HSE Program effective in both qualitative and quantitative measures, Pieridae will conduct planned inspections including: HSE inspections; vehicle inspections; and more detailed HSE Assessments (on large facilities). Personnel that conduct inspections will have the required level of training and experience regarding HSE issues.

7.2 Regular HSE Inspections

Each operating area will establish and maintain an inspection program that is appropriate for the equipment and operations conducted in the operating area. Inspections will be completed as per the schedule and may include daily, weekly, monthly, quarterly, semi-annual and annual inspections. These inspections are documented.

As an example, monthly inspections are sometimes called "safety checks" and include checking above ground storage tanks, fire extinguishers, breathing air, eye wash stations etc. Refer to Appendix 1, Form 15 – Monthly HSE Inspection Checklist. This form can and should be customized to meet the equipment requirements of a particular well or facility. The monthly inspection forms will be retained on file by the Operator and made available for internal audit purposes. Monthly inspections will be integrated into the area PM program.

7.3 Preventative Maintenance

Preventative maintenance (PM) is a formalized plan of maintaining equipment on a regularly scheduled basis in order to identify and repair equipment weaknesses before failure. Preventative maintenance is a regulatory requirement for certain pieces of critical equipment such as emergency shutdowns, relief valves, respiratory equipment, vessels and fire extinguishers. Refer also to the Pressure Equipment Integrity Management System (PEIMS) and Pipeline Safety and Loss Management System (PSLMS).

Each operating area will establish and maintain a formal PM program that is appropriate for the equipment and operations conducted in the operating area. In some operating areas a more detailed preventative maintenance procedure and tracking system may be implemented. A site specific procedure should be developed by each operating area that is specific to the types of wells, facilities and pipeline operations that are in place. The preventative maintenance program will not only include issues relevant to the HSE Program, but operating requirements based on regulations.

Items that require inspection, calibration or testing on a specified schedule should be included and documented. This list should be reviewed by each Area Manager and Area

Operations Engineer to ensure appropriate, compliant schedules are established and implemented for each facility or operating area.

- Glycol dehydrators DEOS updated and posted;
- Fugitive emissions testing completed;
- Calibrate meters (dri-flos, liquid meters);
- Calibrate fire, gas and LEL meters;
- ESD/Presco shutdown tests
- Gas compressor shut down record;
- Satellite/battery shut down/alarms;
- Calibrate VRU transmitter;
- Calibrate personal monitors and bump tests;
- Electrical (high voltage) switchgear;
- Gas analysis;
- Liquid analysis;
- Drivehead oil changes;
- Drivehead/pumpjack servicing;
- ESD valve function tests;
- Flame arrestor checks/cleaning;
- Suspended well checks (including lease inspection guidelines for suspended wells);
- Pressure vessels and PSVs inspected as per regulatory requirements;
- Pipeline vent and flowline checks;
- Above ground tanks inspections;
- Underground tank inspections;
- Packer/isolation tests;
- Surface casing vent checks (reportable);
- Breathing air (SCBA or SABA);
- Fire extinguisher checks (monthly and yearly third party);
- Flare log; and
- Pipeline records.

7.4 Vehicle Inspections

A vehicle inspection will be completed by each Pieridae employee that regularly drives an assigned company vehicle at an inspection frequency deemed appropriate by management. Refer to Appendix 1, Form 23 - Vehicle Inspection Checklist.

7.5 HSE Assessments

It is recognized that HSE issues are often similar and more often, overlap. The systems and processes to achieve HSE objectives are also the same. In order to validate the HSE Program and to streamline the planned inspection component, a blended HSE assessment process will be used. The advantages of an integrated HSE assessment process are as follows:

- Increase efficiency and promote immediate action by immediately and effectively communicating the assessment findings with an Action Plan that is completed as part of the assessment while onsite (and is left onsite for reference);
- Communicate and educate Pieridae employees regarding HSE regulatory and Pieridae policy and procedures;
- Ensure that action items (i.e. corrective actions) are practical and in-line with regulatory compliance and Pieridae policy and procedures;
- Improve direct communication between field and office employees regarding HSE issues;
- Raise overall awareness regarding HSE issues; and
- Provide an opportunity to learn from other Pieridae employees and share ideas and realize efficiencies throughout the process (i.e. internal exchange of ideas and information.

An HSE assessment should be completed on major facilities on an annual basis. The assessment will be completed by an assessment team (e.g. Area Foreman, HSE representative, a representative from the facility being assessed, additionally an operator from another area may be invited for cross-training purposes). To prepare for an HSE assessment, assessors should review the Pieridae HSE Program and the HSE Assessment Form. Refer to Appendix 1, Form 10 – HSE Assessment.

The HSE Assessment is completed on site and a copy of the assessment and action plan is left at the facility. The action plan will be reviewed by the Area Manager and each action item will be evaluated for implementation and addressed by either completing the task or explaining why the task was not completed. The assessment must be kept open until all items are addressed.

7.6 Regulatory Inspections

Regulatory agencies such as the AER routinely complete compliance inspections and/or audits. Industry can use the inspection manuals, such as AER Manual 001: Facility and Wellsite Inspection, to become familiar with regulatory inspections and as a guide for compliance management.

Pieridae representatives should display a positive and cooperative attitude with regulatory inspectors and ensure that regulators visiting Pieridae work sites follow procedures including orientation, visitor safety and PPE requirements.

Regulatory inspectors may, or may not, notify Pieridae representatives prior to an inspection. As soon as field or office, representatives are made aware of an inspection, the inspection results should be communicated to management and deficiencies must be addressed in a timely manner and closed with the regulatory agency.

Inspections will be reported to staff in the HSE Report.

7.7 Records

Inspections	Results are tracked at the area level. Each area will track deficiencies and opportunities for improvement until corrective actions are completed.
HSE Assessments	Action plan is provided following assessment. Area Foreman is responsible track until closure. Actions are tracked on an Excel spreadsheet by HSE team.
External Audits	Tracked by either PEIMS, PSLMS, Insurance/Risk Management or others.
Regulatory Audits	Reported in the monthly HSE Report and tracked until closure is achieved. Reported at the HSEC meeting.

Section 8.0

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8.0 CONTRACTOR SAFETY

8.1 Introduction

Effective communication is of utmost importance and is the equal responsibility of the Pieridae and the contractor. Standard operating procedures are in place to ensure effective communication and documentation of job hazards and job requirements.

Contractors performing work for Pieridae are expected to perform activities in a safe and environmentally responsible manner in accordance with specific craftsman trade rules and regulations. Contractors are responsible for the safety of their employees and will ensure that HSE legislation and regulations are adhered to.

This procedure includes:

- Prime contractor designation and responsibilities;
- Contractor evaluation;
- Pieridae responsibilities;
- Contractor responsibilities;
- General rules;
- Contractor orientation;
- Safe work permitting;
- Pre-job safety meeting; and
- Disciplinary action.

8.2 Prime Contractor Designation and Responsibilities

Every work site must have a prime contractor whenever there will be two or more employers active at a work site at the same time. Examples of this situation would be:

- One contractor and an Pieridae representative present (i.e. a mechanic completing routine maintenance at an Pieridae facility).
- Two or more contractors with an Pieridae representative present (i.e. a pipeline installation project).
- One or more contractors with no Pieridae representative present (i.e. routine operations at remote sites).

The prime contractor for a work site is the contractor who enters into an agreement with Pieridae to be the prime contractor. If no agreement has been made, the prime contractor is Pieridae.

The responsibilities of the prime contractor are:

- To ensure, as far as it is reasonably practicable to do so, that the provincial Occupational Health and Safety Act and Regulations are complied with in respect of

the work site.

The prime contractor will be designated as such within written contracts for service (i.e. larger projects). In cases where the contractor accepts the designation of prime contractor, they must be aware of the responsibility to ensure, as far as it is reasonably practicable, the safety of all workers at the work site.

8.3 Contractor Evaluation

All contractors selected to work on Pieridae operated properties will be required to maintain as minimum qualification the following:

- Current Worker's Compensation Board coverage;
- Insurance of $2,000,000 comprehensive general liability and $2,000,000 automobile liability as minimum insurance amounts; and
- A safety program that satisfies applicable provincial OHS legislation.

When the services of a contract company are required it is important that more than just the criteria listed above are taken into consideration. The following information can be useful:

- Has the company worked for Pieridae in the past? If not, check references.
- Is Pieridae pleased with prior performance?
- What is the nature of the work performed by the company?
- Does the company have a safety program (or a Certificate of Recognition/COR or SECOR)?
- How many man-hours were worked in the previous year?
- How many injuries/illnesses resulted in time away from work (i.e. lost time)?
- Does the company maintain a WCB account in good standing? Request or obtain a WCB clearance letter from the contractor.
    - In Alberta, the DECC can be searched and clearances obtained within minutes. Visit https://my.wcb.ab.ca/decc/Clearance/RequestClearance.aspx
    - In BC, clearance letters can be obtained online. Visit https://www.worksafebc.com/en/insurance/why-clearance-letter/get-clearance-letter

The Calgary office uses the Pieridae Contractor Safety Checklist for all main service providers.

8.4 Pieridae Responsibilities

Pieridae is responsible for promoting and maintaining safe and healthy workplaces and to protect all employees, contractors, the environment and the public. To achieve this, the following fundamental activities will be completed prior to commencing work on Pieridae work sites:

- Pieridae employees and/or work site supervisors will be familiar with the HSE Program.
- For new contractors, a safety orientation will be conducted that may include the distribution of the Contactor's HSE Orientation Pamphlet and completion of the Acknowledgement.
- Prior to beginning work a safe work permit will be issued for hot work and for work as deemed appropriate by the work site supervisor. A safety meeting will be conducted as required. If there are multiple contractors on a large job (i.e. regulated pipeline construction or facility construction) a kick-off meeting or formalized pre-Job safety meeting may be conducted.
- Pieridae work site supervisors will monitor contractor progress and as a minimum will obtain verbal confirmation upon completion of a job.

8.5 Contractor Responsibilities

Contractors performing work for Pieridae are expected to perform activities in a safe and environmentally responsible manner in accordance with specific craftsman trade rules and regulations. Contractors are responsible for the safety of their employees and will ensure that HSE legislation and regulations are adhered to.

In addition to HSE rules and regulations, contractors are expected to comply with Pieridae standard operating procedures as communicated during orientation, safety meetings or the safe work permitting process.

Contractors will:

- Follow applicable laws and regulations;
- Provide trained and qualified personnel competent to complete the designated work;
- Provide HSE training for their employees and maintain records of training certification;
- Perform work in a safe and environmentally responsible manner;
- Cooperate and communicate with Pieridae representatives to understand the work being done and the Pieridae HSE procedures;
- Adhere to Pieridae standard operating procedures as communicated during pre-job safety meetings and/or during the safe work permitting process;
- Ensure that any hazardous materials brought on to the work site are properly labeled in accordance with applicable WHMIS and TDG legislation;
- Report any unsafe conditions to the Pieridae work site supervisor and take steps to address unsafe conditions;
- Have the right and obligation to refuse to conduct unsafe work; and
- Ensure that good housekeeping procedures are maintained.

8.6 Contractor Rules

When working on Pieridae work sites, the following general safety rules will be followed:

- Contractors have in effect a safety program that satisfies applicable government regulations.

- Contractors must have a provincial Workers' Compensation Board account in good standing.
- Contractors must have at least $2,000,000 comprehensive general liability insurance and $2,000,000 automobile liability insurance.
- Contractor's equipment, including personal protection equipment, will comply with applicable legislation and Canadian Standards Association (CSA) standards.
- Hard hats, steel-toed footwear and fire-retardant clothing and safety glasses are required at all work locations. When particular tasks require specific personal protective equipment such as hearing protection or respiratory equipment it will be provided by the contractor.
- Contractors will provide first aid training and equipment for its personnel as per regulatory requirements.
- Contractors must provide appropriate fire extinguishing equipment at the work site.
- All hazardous products used by contractors which are considered controlled products must be appropriately labeled. A Material Safety Data Sheet (MSDS) must be available to anyone working with or exposed to the hazardous product.
- Excavations must be properly shored, cut back, barricaded or fenced.
- All personnel engaged in work where a fall may result shall wear fall arresting devices as per regulations.
- Contractors must practice good housekeeping at the work site. Garbage and waste must be disposed of in appropriate containers and at approved facilities.
- Alcoholic beverages, illegal drugs, prescribed substances, firearms, weapons or explosives are not permitted at Pieridae work sites.
- Persons under the influence of alcohol or drugs are not permitted on Pieridae work sites.
- Smoking is only allowed in designated areas.
- Horseplay, fighting or other disturbances are not allowed.
- Contractors must report all unsafe conditions, unsafe procedures and incidents to the Pieridae work site supervisor.

8.7 Contractor Orientation

For new contractors, a safety orientation will be conducted that may include the distribution of the Contractor's HSE Orientation pamphlet and the completion of the Acknowledgement form contained within. Refer to Appendix 1, Form 04 – Contractor's HSE Orientation.

The Contractor's HSE Orientation pamphlet is a tool to communicate Pieridae HSE procedures to contractors. The pamphlet is not intended to replace the Pieridae HSE Program, the contractor's safety program nor is not intended to override any existing legislation that applies to the work being conducted.

Copies of acknowledgement forms should be retained by the work site supervisor and be made available for audit upon request, or sent to the Calgary office for tracking and file.

8.8 Safe Work Permitting Procedure

Prior to beginning work a safe work permit will be issued to contractors. Refer to Section 6.2 Safe Work Permit.

This procedure is intended to ensure that thorough communication between Pieridae and the contractor is initiated at the onset of work activities and continues on throughout the duration and upon completion of the work. Through this process, safe work conditions will be set, understood and maintained. It is the responsibility of the contractor to relay the contents of the safe work permit to its personnel.

Drilling and completions operations have unique requirements. Refer to 13.4.5 Drilling and Completions Site Safety Assessments.

8.9 Pre-Job Meeting Requirements

Prior to the commencement of work, a pre-job meeting is to be initiated by the Pieridae work site supervisor and appropriate contractor representatives are to be in attendance. The HSE aspects of the meeting will include the following:

- Introduction to project team (attendees);
- Description of work;
- Potential and actual hazards of the proposed work;
- Precautions taken to reduce the hazards;
- Personal protective equipment requirements;
- Emergency procedures (i.e. incident reporting, evacuation procedures, emergency phone list, muster location, alarms, etc.); and
- Special considerations.

Pre-job safety meeting highlights will be recorded on the safe work permit or on a separate Pre-Job Safety Meeting Report form contained in Appendix 1 – Forms, and then attached to the safe work permit. The work site supervisor will be responsible for ensuring that the pre-job safety meeting is completed.

8.10 Contractor Disciplinary Action (Enforcement)

Each contractor requires a WCB account in good standing, insurance in the amount of $2,000,000 and a safety program that satisfies applicable provincial OHS regulations. When the Pieridae work site supervisor issues a safe work permit, conducts a pre-job safety meeting or completes an orientation the contractor agrees to these rules. Pieridae will audit payables for compliance to these rules. Non-compliant contractors will be prohibited from working for Pieridae and invoices will not be paid.

The contractor is responsible to ensure compliance with its own safety program, Pieridae's HSE procedures and any applicable legislation and regulations that apply to the work.

Those individuals who do not fulfill their safety responsibilities will become accountable for any problems their negligence creates and may be liable under law. Contractors are expected to have a process in place to deal with non-compliant workers.

Pieridae reserves the right to terminate contracts and discharge contractors who knowingly violate safety rules or work procedures.

8.11 Safety Ombudsman

Refer to Section 2.9 Safety Ombudsman.

Section 9.0

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9.0 STANDARD OPERATING PROCEDURES

The standard operating procedures contained in this section are intended as a guide in establishing and maintaining a safe work place and to working safely. The standard operating procedures have been developed for hazardous jobs identified through formal hazard assessment. The formal hazard assessment should be updated annually to revisit the hazards and administrative controls presented in this section.

The following nomenclature is used in the Pieridae HSE Program.

- HSE policy - Signed corporate commitment statement.
- Standard operating procedure – Written procedures that have been developed and are contained in the HSE Program. (Note: In some instances, standard operating procedure(s) may also be called a “code of practice” in relation to OHS legislation.)
- Site specific procedure – Written procedures that are a written “step-by-step” instruction for how to safely perform a task from beginning to end (i.e. the execution of procedures or how to “do the work” in practice). If tasks require more detail to perform the work safely than is available in the standard operating procedure, a site specific procedure can be developed. In some cases, manufacturer’s specifications and/or owner operating manuals can also be used for this purpose.
- Rules - A written rule can apply to a range of work. Rules are short and concise. (Refer to Section 2.2 General Rules, and Section 8.6 Contractor Rules.)

If a standard operating procedure is not in place and a hazard exists at a work site, a JHA (job hazard analysis) can be completed as per Section 6.1.6 Job Hazard Analysis and Site Specific Procedure Development of this manual and a written site specific procedure should be developed.

Standard operating procedures are partially based on regulatory requirements but are not intended to be used in substitution of regulations, nor are they intended to be an exhaustive review or interpretation of the applicable legislation. HSE legislation is designed to protect all workers, the public and the environment. All employees and contractors at Pieridae work sites must comply with applicable regulatory requirements.

Regulatory requirements include acts, regulations, codes, policies and procedures that are administered by governments and their agencies. A variety of legislation governs the oil and gas industry, some of which are listed below:

- Federal and Provincial Occupational Health and Safety Acts, Regulations and Codes;
- Provincial Energy, Mines and Resources Acts and Regulations (e.g. Alberta Energy Regulator);
- Provincial Workers’ Compensation Acts and Regulations;
- Workplace Hazardous Materials Information Systems Legislation;
- Transportation of Dangerous Goods Legislation;
- Provincial Boiler and Pressure Vessels Act;
- Building Code of Canada;

- Canadian Electrical Code;
- Alberta Environmental Protection and Enhancement Act;
- Water Act;
- Oil and Gas Conservation Acts and Regulations; and
- Canadian Standards Association (e.g. CSA Z662).

The standard operating procedures should be used as a reference and are intended to be used to assist Pieridae employees to understand and meet regulatory HSE requirements. Due diligence and common sense must be used at all times.

This section will cover 33 standard operating procedures including:

- Aircraft Safety;
- All Terrain Vehicles (ATV's);
- Atmospheric Testing;
- Building and Lease Entry;
- Confined Space Entry;
- Electrical Safety;
- Fire and Explosion Hazard Management;
- First Aid;
- Fit for Work – Fatigue Management;
- Fit for Work - Alcohol/Drug Procedure;
- Fit for Work - Mental Health in the Workplace;
- Ground Disturbance;
- Hand tools;
- Hot Work;
- Housekeeping;
- Hydrogen Sulphide (H2S);
- Isolation (Lock out tag out);
- Lifting (Manual Lifting)
- Lifting and Towing Devices;
- Naturally Occurring Radioactive Materials (NORMs);
- Office Safety;
- Plant Installations;
- Pipeline Integrity;
- Safe Driving;
- Safety Device Bypassing;

- Security and Crime Prevention;
- Signs, Labels and Barricades;
- Silica;
- Tank Gauging;
- Truck Loading/Unloading;
- Welding;
- Wildlife Awareness;
- Working Alone;
- Working at Heights;
- Violence and Harassment Prevention.

9.1 Aircraft Safety

9.1.1 Introduction

Certain operations may require the use of an aircraft or helicopter. The purpose of this section is to provide basic aircraft safety information and passenger conduct expectation.

9.1.2 Responsibilities

Flight Crew/Pilot

- The flight crew or pilot is responsible for the safe operation of the aircraft and the safety of all personnel on board during flight time. The flight crew or pilot will have final authority over all aspects of the operation including the suitability of weather conditions, routing, aircraft servicing and passenger and flight loading.

Passengers

- Passengers are responsible for obeying the flight crew or pilot concerning the conduct of the flight.

9.1.3 General Considerations

- Follow instruction of the flight crew or pilot.
- A seatbelt is required for every passenger. The seatbelt should be secured during takeoff and landing and whenever considered necessary by the pilot or flight crew.
- Each passenger seat shall be provided with printed information listing the emergency equipment carried, and the location and operation of emergency exits.
- Personal baggage and equipment should be properly secured. Cargo should not be placed so as to restrict the use of emergency or regular exits.
- Declare any suspect hazardous materials. Many of these materials are not

allowed to be transported by passenger aircraft.

- The probable temperature in the area of the flight should be known and appropriate footwear and clothing should be worn or carried.
- Passengers should not board, leave or work around aircraft when propellers or rotors are in motion. The helicopter is often an exception to this rule when rotors must be kept in motion at remote landing sites. The following are general guidelines for helicopter safety:
    - Passengers should receive a through briefing from the pilot or flight crew before boarding or leaving a running helicopter.
    - Keep clear of the helipad until the helicopter has landed.
    - Keep all lightweight articles (raincoats, windbreakers) secured while the helicopter is approaching or departing.
    - Approach or depart the helicopter only on signal or command from the pilot.
    - Approach or depart the helicopter from the front quadrants or either side to avoid the tail rotor. Under no circumstances walk near or under the tail rotor.
    - Crouch and keep your arms/hands below should height when approaching or departing the helicopter. Beware of the large main rotor and its updraft.
    - Keep a firm grip on articles, including hard hats, when walking to and from the helicopter.

9.1.4 Reporting Aircraft Incidents

Aircraft incidents should be reported. Refer to Appendix 1, Form 11a Incident Report.

9.2 All Terrain Vehicles (ATV's)

9.2.1 Introduction

Certain operating areas may require the use of all terrain vehicles (ATV's) or snowmobiles to access facilities. Improper use of the equipment can result in personal injury and property damage. The ATV must be operated in a safe manner at all times, with the operator maintaining full control of the unit. Specific potential hazards include: rollovers; driving on roads; rough terrain; possible bear or wildlife encounters; mechanical failure; remote locations with minimal communication.

9.2.2 General Considerations

Workers who operate ATV's must ensure that:

- Only workers who have had instruction and have demonstrated competency on proper operation and safety shall operate these vehicles;
- Follow proper maintenance procedures;

- Report unsafe equipment and/or operating conditions as soon as possible;
- Ensure that traveling speeds are appropriate for the conditions; and
- Ensure the tracks and undercarriage are kept free of debris (be aware of potential fire hazard and/or bans that may be in place).

9.2.3 ATV Equipment and PPE

- Equipment operating manuals must be available on the vehicle;
- Standard PPE must be worn, including leather gloves.
- A suitable helmet must be worn (i.e. DOT approved helmet). Refer to Section 5.3 Head Protection;
- Communication must be available (i.e. cell phone and where cell phone coverage is insufficient, radio and/or satellite phone in ATV box); and
- Bear spray and air horn should be carried in a ATV box for use when off the vehicle.

9.2.4 ATV Operation

- Check ATV for damage, do a walk around.
- Check the following: tire pressure, oil level, coolant level, ensure fuel is full; ensure lights are working.
- Check communication equipment is fully charged and/or ready for use.
- If working in a core operating area, production operators must check in with another operator, supervisor or facility control room. Provide details of trip including route and destination and expected travel time/check in time.
- Drive within posted speed limit on roads. The posted speed limit is not the target speed when operating an ATV. Drivers must drive slowly and appropriate to the road conditions, being aware of the potential for wildlife or other traffic that may be in the area.
- Drive with caution when leaving roads into rough terrain.
- Upon arrival at destination, check in as established prior to the trip.
- Upon return, check in as established prior to the trip.
- Prepare the ATV for the next trip (fill fuel, fill fluids, clean unit, etc.)

9.3 Atmospheric Testing

9.3.1 Introduction

Before entering a confined space or before conducting work where there is a potential atmospheric hazard or before conducting work in a hazardous area, atmospheric testing must be done to ensure that levels of oxygen are adequate, the atmosphere is not explosive and toxic atmospheres are known. Additional interval or continuous testing may be required to ensure the worker's continued safety while working inside a confined space. Testing must be conducted by

trained personnel and documented on the safe work permit and/or the accompanying watchman's log.

When it is necessary to enter a confined space to conduct testing, self-contained or air-supplied breathing apparatus must be worn. Refer to Section 9.5 Confined Space Entry.

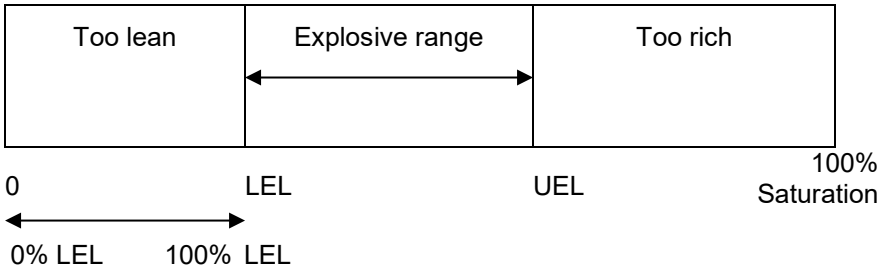
9.3.2 Oxygen Concentration

- Less than 19.5% - Atmosphere prohibits entry without air supply. Entry required to correct dangerous condition or to complete cleaning.
- 19.5%-23% - Entry without supplied air respirator is acceptable, providing that other exposure limits are met.
- Greater than 23% - Atmosphere prohibits entry without air supply. Entry required to correct dangerous condition or to complete cleaning.

9.3.3 Flammable Concentration

- The most common unit of measurement is the percentage of lower explosive limit (%LEL).
- The LEL is the minimum amount of fuel that must be present in air to burn. If there is too little fuel, the air/fuel mixture is considered to "lean" and will not burn. The upper explosive limit (UEL) is the maximum amount of fuel that must be present in area to burn. If there is too much fuel, the air/fuel mixture is considered too "rich" and will not burn. (See Figure below entitled Graphic Explanation of LEL and UEL.)

Graphic Explanation of LEL and UEL



- Using methane as an example, a 5.3 percent mixture of methane vapor in air (100 percent of its LEL) is a high enough concentration to ignite and explode in the presence of an ignition source. When methane vapors reach its LEL of 5.3 percent, a properly calibrated gas monitor (specifically calibrated for methane) will report the reading as 100 percent of the LEL. If the amount of methane vapor in the air is 0.53 percent, then the instrument will report the reading as 10 percent of the LEL. (See Figure below entitled LEL and UEL Limits for Selected Hydrocarbon Gases and Liquids). Refer to Section 5.11 Gas Detection Equipment (Personal Monitors).

LEL and UEL Limits for Selected Hydrocarbon Gases

Flammable substance	Lower Explosive Limit (LEL)	Upper Explosive Limit (UEL)
Methane	5.3%	15%
Ethane	3%	12.5%
Propane	2.3%	9.5%
Butane	1.9%	8.5%
Hydrogen sulphide	4.0%	46%
Toluene	1.27%	7.0%
Gasoline	1.3%	6.0%
Cutter oil	1.1%	6.0%
Envirovert (drilling fluid)	0.7%	6.0%
Crude oil	1%	10%

- To ensure the health and safety of workers, gas monitor readings in work areas should not exceed 20 percent of the LEL.

9.3.4 Toxic Atmospheres

A general Occupational Exposure Limit (OEL) for petroleum vapors cannot be given because the constituent hydrocarbons have different toxicities.

In Alberta, hydrogen sulphide (H_2S) has an 8-hour occupational exposure limit of 10ppm; and a 15-minute ceiling occupational exposure limit of 15ppm.

In BC, hydrogen sulphide (H_2S) is a Ceiling Limit (not to be exceeded) of 10 ppm. At levels above this ceiling, only workers who are trained in the hazards of H_2S and are wearing required protective equipment may enter the work area

When sludge is removed from a tank or vessel in preparation for work, there may be a local release of hydrocarbon vapor near the surface. This is unavoidable even when there has been thorough wetting down. It is therefore recommended that regular checks be made of the overall atmosphere, near head height, to monitor that it does not exceed 20% of the lower explosive limit. The use of continuous gas monitors is recommended.

9.3.5 Iron Sulphide Fires

Iron sulphide is a pyrophoric material. This means that it can spontaneously ignite when exposed to air. It is created when iron oxide (rust) is converted into iron sulphide in an oxygen-free atmosphere where hydrogen sulphide gas is present or where the concentration of H_2S exceeds that of oxygen.

When iron sulphide is subsequently exposed to air, it is oxidized back to iron oxide and either sulfur or sulfur dioxide gas is formed. This chemical reaction between iron sulphide and oxygen generates a considerable amount of heat, so much heat is released that individual particles of iron sulphide become incandescent and glow. This heat can ignite nearby flammable mixtures. Pyrophoric iron fires most commonly occur during shutdowns when equipment and piping are opened for inspection or maintenance.

Iron sulphide fires can be avoided by preventing the sulphide from contacting air. This can be achieved by maintaining a continuous layer of liquid or inert gas between the material and the air. Inerting vessels with nitrogen gas is one such method.

Additional mitigations that should be considered when decontaminating any potential iron sulphide containing system include:

- Applying chemical neutralization before exposing the equipment to air, for example circulating a potassium permanganate (KMnO4) solution (typically around a 1% solution). After circulation, check for color. A purple color indicates the presence of excess KMnO4 and, as such, maximum neutralization.
- Keeping the deposits and scale wet until it can be safely removed to a remote area and allowed to dry.
- Maintaining a constant air ventilation to ensure there is plenty of oxygen to allow the reaction to go to completion, preventing the formation or the pyrophoric intermediates.
- Replacing components that contain sulfur compounds.
- Using nitrogen or other inert gases to keep oxygen out (adds hazards of its own).

Quickly moving scale and potential pyrophoric deposits to a remote area and monitoring in case ignition does occur.

9.4 Building and Lease Entry

9.4.1 Introduction

This procedure is intended to be used by all production operators while completing a task or set of tasks in Pieridae's operating areas. This procedure applies specifically to entering leases and buildings on operating sites. Potential hazards include: sweet or sour hydrocarbon releases; chemical releases; congestion (men working or equipment).

Operators wear personal monitors as part of standard PPE. Safe atmospheric conditions are: oxygen between 19.5-23%; LEL less than 20% (or lower); H_2S less than 10ppm (or lower); and CO below 25ppm. Please note that the personal

monitor will not detect all unsafe conditions, only the gas for which it is calibrated. For information on specific chemicals refer to the (M)SDS. For regulatory exposure limits, refer to the OHS Code, Schedule 1, Table 2 Occupational Exposure Limits for Chemical Substances. Refer to Section 9.3 Atmospheric Testing and Section 5.11 Gas Detection Equipment (Personal Monitors).

9.4.2 Lease Entry

- Check lease signage for information that could be present at the location.
- Be aware of the wind direction. Sour sites will likely have wind socks. Where possible, avoid approaching from downwind. Open vehicle window and visually check and listen for gas leaks or hazards when approaching. At leases with a normally ignited flare, check to see if flame is visible.
- Where possible, face vehicle towards the lease exit so that during an emergency the site can be left quickly should an emergency occur.
- Entry into an area can only be done when atmospheric conditions are safe. Never enter an area or building if atmospheric conditions are not safe without calling for back up and donning adequate PPE.
- When leaving the work site/lease, shut and lock the gate (if equipped).

9.4.3 Building Entry

- When entering buildings that are equipped with fixed monitoring (i.e. permanently mounted H_2S, LEL, or other detection) take note of any alarms at the site. This can be done by noting any audible or visual alarms, checking detections status of MCC or requesting that a Control Room check the status via systems.
- When entering buildings that do not have fixed monitoring (i.e. do not have permanently mounted H_2S, LEL, or other detection) approach the building or equipment cautiously. Listen for anything unusual, use the windows to look inside the building.
- If equipped, use the “doggy door” to pre-check conditions inside the building prior to opening the door. Checking the building atmosphere will give the worker an indication of leaks that can be repaired.
- Entry into an area can only be done when atmospheric conditions are safe. Never enter an area or building if atmospheric conditions are not safe without calling for back up and donning proper PPE.
- Open the door while standing to the side.
- Leave the door open, or latch the door open, to prevent gas buildup during occupancy.
- When tasks are complete in the building, close doors.

9.5 Confined Space Entry

9.5.1 Introduction

This standard operating procedure outlines the requirements for entering and working in confined spaces. A detailed site/job specific code of practice is required where a worker works in a confined space on a regular basis as per the Alberta Occupational Health and Safety Act. To satisfy this requirement, a site specific procedure can be developed or a safe work permit in combination with a confined space entry permit should be used.

The safety requirements for confined space entry will vary from one situation to the next depending on the nature of the confined space (i.e. vessels, trenches, tanks etc). Therefore, different types of confined spaces, with their unique hazards, must be identified on the confined space permit and communicated to workers involved with the entry.

Hazards associated with the presence of harmful substances or the deficiency of oxygen in a confined space must be reduced or eliminated. Proper completion of the safe work permit and the confined space permit will methodically address and communicate hazard identification and measures taken to eliminate these hazards.

Hazards commonly encountered in confined spaces include:

- Corrosive, toxic, oxygen deficient or flammable/explosive atmospheres, either as a normal characteristic of the space or because of the work being performed;
- Contaminants entering from other areas via ducts or piping;
- Temperature extremes (hot or cold);
- Electrical shock or ignition of flammable gases from portable lights, tools or associated electrical equipment;
- Injury from mechanical equipment;
- Abnormal weather conditions such as electrical storms or extreme inversions with no wind;
- Operation of equipment and/or work procedures; and
- Slips or falls.

This procedure will provide the following information:

- Definitions;
- Responsibilities;
- Training and instruction;
- Personal protective equipment;

- Isolation;
- Ventilation;
- Testing and inspection;
- Cleaning;
- Entry;
- Rescue; and
- Job completion.

9.5.2 Definitions

Clean Respirable Air

- Clean respirable air when used to describe the atmosphere inside a confined space, means an atmosphere which is equivalent to clean, outdoor air and which contains: about 20.9% oxygen by volume; no measurable flammable gas or vapor as determined using a combustible gas measuring instrument; and no air contaminant in concentrations exceeding either 10% of its applicable exposure limit or an acceptable ambient air quality standard

Confined Space

- A confined space means an enclosed or partially enclosed space that is not designed or intended for continuous human occupancy with a restricted means of entry or exit and may become hazardous to a worker entering it because: of its design, construction location or atmosphere; of the work activities, materials or substances in it; the provision of first aid, evacuation, rescue or other emergency response service is compromised; or of other hazards relating to it.

Confined Space Permit

- A confined space permit will be completed prior to a confined space entry. The permit contains information regarding hazardous atmospheres, a confined space pre-entry and rescue plan. Refer to Appendix 1, Form 03 - Confined Space Entry Permit.

Flammable Range

- The minimum and maximum concentration range of a flammable vapor in air that can ignite on contact with an ignition source.

Lower Explosive Limit (LEL)

- Minimum concentration of a flammable vapor in air that will burn. Below the LEL, the mixture is too “lean” to burn.

Upper Explosive Limit (UEL)

- The maximum concentration of flammable vapor in air that will burn. Above the UEL, the mixture is too “rich” to burn (not enough oxygen).

Oxygen Deficient Atmosphere

- An atmosphere where the oxygen content is less than 19.5 percent by volume at sea level.

Oxygen Enriched Atmosphere

- An atmosphere where the oxygen content is greater than 23.0 percent by volume at sea level.

Portable Instrumentation

- Usually hand-held instruments used to test an atmosphere by electronic or chemical means for flammability, toxicity, oxygen content, or particulate contaminant. Some instruments are capable of detecting more than one type of contaminant.
- Some instruments will operate continuously for several hours and may be placed in or near the working area. Instrument operators must know the capabilities and limitations of the instruments, and ensure they are fully functional before using it to test an atmosphere.

Rescue Team

- A trained team (confined space and rescue training) must be in attendance during a confined space entry when a non-entry rescue technique cannot be used.

9.5.3 Confined Space Types (Restricted/Confined)

Alberta OHS distinguishes between restricted spaces and confined spaces as follows:

- Restricted space means an enclosed or partially enclosed space, not designed or intended for continuous human occupancy that has a restricted, limited or impeded means of entry or exit because of its construction.
- Confined space means a space which may become hazardous to a worker entering it because of: an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity; a condition or changing set of circumstances within the space that presents a potential for injury or illness; or the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

All restricted/confined spaces at a work site that may be required or permitted to be entered (i.e. for planned or unplanned maintenance or in an emergency) must be identified and assessed prior to entry. Reasonable precautions should be taken to prevent any unauthorized entry into restricted/confined spaces.

In BC, OHS requires that permits are required before a worker enters a confined space with a high hazard atmosphere, that requires lockout or isolations procedures, or in which there is a hazard of entrapment or engulfment.

9.5.4 Responsibilities

To conduct a confined space entry, a safe work permit and confined space permit will be issued by the work site supervisor or a trained representative (i.e. safety company). The completion of the permits substantiate that a trained person has evaluated all existing hazards and taken the necessary precautions to protect the safety of the workers.

9.5.5 Training and Instruction

The work to be performed shall be under the direction of a work site supervisor who is aware of the hazards that may be encountered, and is trained in first aid and confined space entry. Refer to Section 4.6.1 Confined Space Entry.

In some cases, it may be appropriate to hire a safety company to facilitate a confined space entry.

All workers connected with or performing the work in the confined space shall, before entry, be informed of: the hazards that may be encountered; precautionary measures; and rescue methods. This is accomplished through the proper use of a safe work and confined space permits.

The work site supervisor must also ensure that all personnel associated with the confined space entry (entering or rescuing) are trained in the use, care and maintenance of respiratory equipment (i.e. have H_2S training) and other safety and rescue equipment pertaining to the job (i.e. accomplished via the pre-job safety meeting.

9.5.6 Personal Protective Equipment

Appropriate personal protection such as suitable clothing, gloves, boots, eye protection, face protection and respiratory apparatus must be worn to meet the requirements of the job. Refer to Section 5.0 Personal Protective Equipment.

9.5.7 Isolation

Refer to Section 9.17 Isolation (Lock Out Tag Out).

9.5.8 Atmospheric Testing

Refer to Section 9.3 Atmospheric Testing.

9.5.9 Cleaning, Ventilation and Purging

When a confined space is known or shown by pre-entry testing to contain an atmospheric hazard, the hazard must be controlled by cleaning, purging or venting the space.

The dead-ends of a line that has been isolated must also be cleaned, purged or vented to remove any harmful substance that could present a hazard to a worker entering the confined space.

If a safe atmosphere cannot be assured through cleaning, ventilation and purging, the following precautions must be taken:

- all workers entering the space must wear appropriate PPE including respirators when necessary,
- the workers must be attended by a standby worker,

- the atmosphere must be continuously monitored,
- the concentrations of flammable gases and vapors must be maintained below 20% of the lower explosive limit,
- if flammable or explosive gases, vapors or liquids are present, all sources of ignition must be eliminated or adequately controlled, and
- an appropriate rescue plan and team must be in place.

Cleaning

Depending on the nature of the confined space contents, the vessel must be emptied of residual material by being drained, pumped out, floated off and made clean by hot or cold water flushing, steaming, chemical neutralization, inert gas or air purge.

- Sludge should be removed, when possible, from outside the confined space.
- Iron sulphide should be kept damp until removed and disposed. Refer to Section 9.3.5 Iron Sulphide Fires.
- To reduce the possibility of build-up of static electricity, proper bonding and proper grounding procedures should be followed.

Ventilating and Purging

Ventilating means the use of mechanical ventilation to force fresh air into the confined space while workers are working. Purging means the introduction of substances such as inert gas, steam or water to displace or flush out contaminants prior to workers entering the space.

If atmospheric testing identifies that a hazardous atmosphere is present or is likely to be present in a confined space, the space must be ventilated, purged or both before a worker enters the confined space. If ventilating or purging is impractical or does not eliminate atmospheric hazards, workers are then required to wear appropriate PPE. PPE is not an acceptable method of worker protection from flammable or explosive atmospheres.

If a contaminant is produced in a confined space, it must be controlled by general ventilation or a local exhaust ventilation system.

If mechanical ventilation is required to maintain a safe work atmosphere within a confined space, then the ventilation system must incorporate a method of alerting workers if the system fails. Workers must be trained in the evacuation procedures to be used if the ventilation system fails.

9.5.10 Inerting

Inerting means the introduction of an inert (non-reactive) gas such as nitrogen into a confined space to completely displace all oxygen.

For a flammable mixture to burn or explode, a source of oxygen and a source of ignition are required. Inerting is a technique that is used to remove air and the oxygen that it contains. This creates an oxygen-deficient atmosphere and workers who enter the space must be properly trained and equipped with self-contained breathing air.

Note that LEL meters will not read properly when oxygen levels are less than 10%. Without enough oxygen, these meters can give an incorrect low reading. Refer to Section 5.11 Gas Detection Equipment (Personal Monitors).

9.5.11 Confined Space Entry Permit

A confined space entry permit will be completed as prior to entry into a confined space.

The permit contains information regarding hazardous atmospheres, a confined space pre-entry and rescue plan. The Pieridae form(s) may be used, or a client-equivalent, or a safety-company equivalent. Refer to Appendix 1, Form 03 - Confined Space Entry Permit. The names of the workers who enter the space are identified on the associated watchman's log. Refer to Appendix 1, Form 22 - Watchman's Log.

Confined space entry permits must be readily available at the site of the confined space work and in BC must be posted.

9.5.12 Standby Worker

A standby worker must be designated for restricted/confined space entry to monitor worker safety. The language differs between provinces (Alberta and BC), however the intent is the same. In the case of a confined space with a high hazard atmosphere there must be a standby person must be specifically assigned to the task. The responsibilities of the standby worker will depend on the type of space being entered as follows:

For restricted space entry in Alberta, the designated standby worker must:

- be in communication with the worker in the restricted space; and
- have a suitable system for summoning assistance.

For confined space entry in Alberta, the designated standby person must:

- be stationed at or near the entrance to the space (in Alberta only, there is an allowance for the standby worker to be located at a remote monitoring station);
- be in constant communication with the workers inside the space;
- keep track at all times of the number of workers inside the space; and
- have a suitable system for summoning assistance.

Note: If a remote monitoring system is used (allowed in Alberta only):

- it must be physically located at the same work site as the confined space work;
- it must have a live video display simultaneously showing both the outside entrance area and work inside the space;
- the standby worker must have two way communication with each worker inside the confined space; and
- the standby worker must only be assigned to monitor as many confined spaces and workers as is reasonable to ensure sufficient attention is provided.

In BC:

- For a low hazard atmosphere, there must be an assigned standby person, with a continuous means of summoning the standby person, and the standby person must check on the well-being of the workers inside the space at lease every 20 minutes, and the standby person must have a means to immediately summon rescue personnel.
- For a moderate hazard atmosphere there must be an assigned standby person, who is stationed near the entrance to the space, and the standby person must visually observe or otherwise check the well-being of the workers inside the space, as often as may be required by the nature of the work, but at least every 20 minutes.
- For a high hazard atmosphere where there is a chance of engulfment or entrapment there must be an assigned standby person, the standby person must be stationed at the entrance to the space and must continuously attend the standby duties; the standby person must visually observe or otherwise continuously monitor the well-being of the workers inside the space, there must be a continuous means of summoning the standby person from inside the space, the standby person must be equipped and cable of immediately effecting rescue using lifting equipment if required, or otherwise performing the duties of rescue persons, and the standby person must prevent the entanglement of lifelines and other equipment.

9.5.13 Entry

The hazards inherent in confined space entry can be avoided or overcome if the following precautions are applied each and every time a confined space is entered by a worker:

- Specific written procedures (a confined space permit) must be prepared to include all the considerations contained in this section, plus any additional information needed to accomplish the work safely.
- When the confined space work calls for workers to wear self-contained or air-supplied breathing apparatus, and rescue in an emergency may be difficult, the worker should wear a body harness with lifeline attached and leading to a standby worker.

- Lifelines should not be used if conditions make its use impractical or unsafe. If one or more workers enter a confined space, provision must be made to prevent entanglement of lifelines and other equipment.
- A trained team (confined space and rescue training) capable of entering the space and effecting rescue must be in attendance during a confined space entry when a non-entry rescue technique using harnesses, lifelines and lifting equipment cannot be affected.
- A communication system must be in place to ensure that information can easily and effectively be passed from inside worker to outside worker to worker, worker to standby worker, standby worker to work site supervisor and work site supervisor to additional support.
- There must be a standby worker at the confined space entrance who is equipped with respiratory protection and other applicable emergency equipment, is capable of effecting a rescue as required, and is able to communicate at all times with the worker inside. A communication system must be in place to ensure that information can easily and effectively be passed from inside worker to outside worker to worker, worker to standby worker, standby worker to work site supervisor and work site supervisor to additional support.
- When a lifeline is used for communication, a predetermined series of tugs on the line will be used. It is essential that this code be standardized on the work site to eliminate confusion. The standby worker will be required to hold the lifeline at all times. The standby worker must not leave their post unless replaced by a trained person.
- The supervisor should notify the standby worker of any dangerous situations which may arise in the area of the confined space.
- Entry without respiratory and skin protection may proceed provided the atmosphere is tested for contaminants and monitored throughout the job to ensure that concentrations remain below specified exposure limits. These limits are considered the maximum average atmospheric concentration of contaminant that workers may be exposed to during an eight-hour day.
- Beware of confined space oxygen deficiencies. Always test the atmosphere for its oxygen content before entry or re-entry after a work break. Minimum oxygen content shall be no less than 19.5% by volume.
- Where any ignition source is to be introduced into the confined space, a combustible gas test of the atmosphere in the confined space is required immediately prior to the commencement of the job and frequently throughout the job to ensure zero percent LEL.
- All electrical tools and equipment used in a confined space with a potential flammable or explosive atmosphere must meet applicable electrical classification standards.
- Non-sparking tools should be used in confined spaces where flammable or explosive gases, vapors or liquids are present.
- Where traffic hazards may exist, appropriate barricades and warning signs should be provided to keep vehicle and pedestrian traffic away.

9.5.14 Rescue

Rescue is an integral part of confined space entry and requires the same emphasis as the rest of the confined space procedures. The type of rescue should be explained to the workers and the necessary equipment must be readily available to affect a rescue should it be required.

If the work crew is inexperienced, or the type of confined space entry is different or more hazardous than others, a dry-run simulated rescue is recommended to familiarize the workers with the equipment and specialized techniques.

General Rescue Equipment

As confined spaces vary in design, the equipment necessary to conduct a rescue will also vary. The following list is general but can apply to most confined spaces:

- Communication equipment;
- First aid equipment;
- Personal protective equipment;
- Extraction equipment; and
- Additional equipment such as fire extinguishers, hazardous substance detection equipment, safety shower, eye wash or other suitable source of water, air movers, planks and scaffolding.

Safe Rescue Procedures

- Practice with rescue equipment;
- In the event of an emergency, evaluate the situation. Determine as quickly as possible:
  - The hazards associated with confined spaces;
  - The degree of incapacitation of the worker;
  - The rescue route; and
  - The location of other workers.
- Wear the necessary clothing and respiratory protective equipment;
- SCBA or supplied air must be used during rescue operations in an unknown of immediately dangerous to life and health atmosphere.
- Do not attempt a rescue alone, unless circumstances require it and a call has been placed for help;
- Administer the necessary first aid to the incapacitated worker;
- Move the incapacitated worker only if necessary, and then do it carefully and safely; and
- Arrange transport for the worker to a medical facility.

9.5.15 Job Completion

At the end of a job, a thorough check should be made by the work site supervisor to ensure that no workers, tools or equipment have been left inside the confined

space. Double-check and ensure that all workers are accounted for before leaving the confined space.

The rescue team should be notified that the work has been completed and that the confined space is clear.

Ensure that all blinds have been removed, valves returned to their correct positions and the vessels have been purged to ensure ambient air containing oxygen has been removed.

Return the safe work permit and confined space entry permit to the work site supervisor for finalization before operation is returned to service.

Confined space records must be retained for not less than one year if no incident or unplanned event occurred during the entry or two years if an unplanned event or incident occurred during entry.

9.5.16 Confined Space Checklist

The following checklist can be used as a reference and is similar to a code of practice:

- ❑ Use proper permits.
- ❑ Identify hazards.
- ❑ Identify personal protective equipment requirements.
  - Suitable clothing, boots, gloves, and head, eye and face protection.
  - Proper respiratory equipment.
  - Proper rescue equipment.
- ❑ Specify the atmospheric tests and testing frequency on the safe work and/or confined space entry permits.
- ❑ Document atmospheric tests on the watchman's log.
- ❑ Conduct a pre-job safety meeting with all workers involved with the confined space entry.
  - Review specific hazards and controls;
  - Discuss isolations/lock outs;
  - Discuss hazards involved during various phases of the work;
  - Identify any auxiliary equipment requirements; and
  - Develop a rescue plan.
- ❑ Verify that all tests specified on permit are conducted and that all equipment specified on the permits are in place.
- ❑ Determine rescue requirements.

- Ensure a rescue plan is in place and that standby workers and/or rescue team is onsite.
- Notify the rescue team when work when the space is entered.
- Determine communication equipment needs for entrants and rescuers.
  - All communication equipment used in hazardous atmospheres shall be intrinsically safe and shall meet electrical classification standards.

❑ Determine lighting requirements.

- Lighting must be intrinsically safe.

❑ Isolate equipment.

- Vessels and tanks must be isolated. Piping systems entering the vessel or tank must be blinded / isolated in accordance with this procedure and the lock out / tag out procedures.
- Visually check or otherwise verify isolations prior to entry.

❑ Perform electrical isolation.

- Test equipment from the start / stop switch to ensure that it is locked out.

❑ Record isolations.

❑ Prepare vessels (drain and depressure).

- May involve flushing, steaming or chemical neutralization.

❑ Enter confined space.

- Track entry into and out of the confined space on the watchman's log.
- Review initial gas tests and continue to test confined space atmosphere on a predetermined frequency.
  - Measure oxygen content, combustible gases (LEL) and toxicity.
  - Use a watchman's log to record this information.
- Provide ongoing monitoring.
  - Maintain constant/ongoing communication with personnel working inside a confined space.

❑ Post entry.

- Check confined space to ensure it is clear of personnel, tools and equipment.
- Notify rescue team when all workers have completed work and exited the space.
- Ensure all blinds are removed (as per the blind list).
- Close out safe work permit and confined space permit.

9.6 Electrical Safety

9.6.1 Introduction

All work involving electricity will be performed in accordance with the Canadian Electrical Code. Only qualified electrical personnel are permitted to perform electrical repair, maintenance and construction work as per the applicable provincial regulations or as otherwise specified.

This section will cover:

- General considerations;
- Electrical stand-off;
- Underground power lines;
- Temporary power lines;
- Hazardous locations; and
- Grounding and bonding.

9.6.2 General Considerations

Only qualified electrical personnel are permitted to perform electrical repair, maintenance and construction work as per the applicable provincial regulations or as otherwise specified within the contract documents.

Electrical contractors are required to have adequate training and experience making them capable of performing the job at hand.

All electrical switch gear lines or equipment shall be de-energized, purged, tested, grounded, locked out and tagged by authorized Pieridae personnel prior to workers working on or around them. The work site supervisor must approve any special circumstances which may warrant an exception.

Any electrical work for final terminations/connections in production operations should be performed under a safe work permit.

Workers must use only explosion proof and/or intrinsically safe equipment in specified areas.

9.6.3 Electrical Stand-Off

No worker, part of a lifting device, or any other equipment being operated around live overhead power lines will be operated closer than 7m of a live overhead power line unless they are at least working at the distances outlined in the Electrical Stand-off table. The distances outlined are regulatory requirements and they must be complied with at all times. Signs and barriers shall be put in place prior to work

being done to identify the safe working distances and inform workers of the overhead hazard.

The clearances shown in the Electrical Stand-off table apply in both vertical and horizontal directions. If there is a necessity to work closer than the minimum distances specified, the utility company for the area must be contacted for authorization and must be onsite to direct any work being done.

Electrical Stand-off

Operating Voltage of Overhead Power Line Between Conductors	Safe Limit of Approach for Persons and Equipment
0 – 750 volts (insulated or polyethylene covered conductors)(1)	300mm (or 30cm)
Above 750 volts (insulated conductors)(1)(2)	1.0m
0 – 40 kV	3.0m
69kV, 72kV	3.5m
138kV, 144kV	4.0m
230kV, 240kV	5.0m
500kV	7.0m

(1) Conductors must be insulated or covered throughout their entire length to comply with these groups.

(2) Conductors must be manufactured to rated and tested insulation levels.

9.6.4 Underground Power Lines

Before any ground disturbance activities are undertaken, the location of all underground facilities must be located. Refer to Section 9.12 Ground Disturbance.

9.6.5 Temporary Power Lines

Temporary power lines are to be installed and clearly marked in a manner to prevent the storage of material beneath the line and to control the travel of mobile equipment under or near the line. All lines must be properly supported and must not constitute a hazard to workers.

Extension cords are to be properly stored and maintained in good working order.

9.6.6 Hazardous Locations

Hazardous locations are defined in the Canadian Electrical Code. In general, the majority of production facility work sites will fall under Class I, Division 1 or 2 (existing sites before 1998) or Class 1, Zone 1 or 2 (new sites after 1998) rating.

Proper classification requires an understanding and experience of the various parameters such as normal process conditions and ventilation and should be completed by a qualified electrical technician.

The intent of this section is to provide general information regarding the definitions for the three zones on which to base the area classification of a hazardous location. The design requirements for equipment in the Canadian Electrical Code, Part II Standards are based on the equipment being installed in areas that meet these definitions. As the areas are classified on the basis of the frequency and duration of the occurrence of concentrations of gas above the LEL, the area classification may well be reduced as the result of ventilation. Area classifications are done for normal operating conditions, not for abnormal situations where there has been a loss of containment such as a ruptured vessel or a failed seal.

Class I

Locations in which flammable gases or vapours are or may be present in the air in quantities sufficient to produce explosive gas atmospheres. Class I locations are further divided into three Zones based upon frequency of occurrence and duration of an explosive gas atmosphere as follows:

- **Zone 0** comprising Class I locations in which explosive gas atmospheres are present continuously or are present for long periods;
- **Zone 1** comprising Class I locations in which:
  - Explosive gas atmospheres are likely to occur in normal operation; or
  - Explosive gas atmospheres may exist frequently because of repair or maintenance operations or because of leakage; or
  - The location is adjacent to a Class I, Zone 0 location, from which explosive gas atmospheres could be communicated.
- **Zone 2**, comprising Class I locations in which;
  - Explosive gas atmospheres are not likely to occur in normal operation and, if they do occur, they will exist for a short time only; or
  - Flammable volatile liquids, flammable gases, or vapours are handled, processed, or used, but in which liquids, gases, or vapours are normally confined within closed containers or closed systems from which they can escape only as a result of accidental rupture or breakdown of the containers or systems or the abnormal operation of the equipment by which the liquids or gases are handled, processed, or used; or
  - Explosive gas atmospheres are normally prevented by adequate ventilation but which may occur as a result of failure or abnormal operation of the ventilation system; or
  - The location is adjacent to a Class I, Zone 1 location from which explosive gas atmospheres could be communicated, unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

The rationale for the three distinct zones is based on the frequency and duration of the presence of an explosive gas atmosphere. In order to have an explosive gas atmosphere, the concentration of the gas or vapour must be above the Lower Explosive Limit (LEL) but below the Upper Explosive Limit (UEL). The presence of gases or vapours below the LEL does not necessarily indicate a hazardous location if they will never reach concentrations above the LEL (an example would be the area around a natural gas furnace).

Examples of the various zones of hazardous areas include:

- Class 1, Zone 0 – vapour space inside enclosed vessels or tanks containing a substance capable of producing an explosive gas atmosphere
- Class 1, Zone 1 – the area within 1.5m of a tool launcher/receiver opening; an enclosed gas compressor building
- Class 1, Zone 2 – outdoor or unenclosed areas within 3m in any direction of a potential source of leakage of flammable liquid, gas or vapour; the area within 3m of a door of an enclosed gas compressor building

9.6.7 Grounding and Bonding

Grounding and bonding are techniques used to prevent sparks (a source of ignition) from being created when liquids are transferred between containers.

The usual precaution to avoid static electricity sparking is to ensure proper bonding and/or grounding of equipment, vessels, or containers, etc.

Bonding equalizes the potential between the objects bonded, but does not eliminate a difference in potential between these objects and the earth. Bonding is defined by the National Electrical Code as the permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to safely conduct any current likely to be imposed. Bonding is when there is an electrical connection between two or more conductive containers. Bonding ensures that the containers have the same electrical charge. Without a difference in charge or “electrical potential”, a spark cannot be created that jumps from one container to another. Bonding also includes when parts of equipment and containers that are electrically separated (for example, by gaskets or caulking compounds) are connected. Bonding does not eliminate the static charge which is why it is used in combination with grounding.

Grounding is defined by the National Electrical Code as a conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or some conducting body that serves in place of the earth. Some static charge may remain (i.e. difference in potential) after bonding unless one of the objects that has been bonded possesses an adequate conductive path to the earth through a grounding connection. A container is grounded when there is an

electrical connection between the container and the earth. Grounding quickly drains away the static charge.

Bonding and grounding systems should be checked regularly for condition. Overall resistance of the system can be determined with an ohmmeter and static voltmeters can be used to determine the effectiveness of a ground system.

Serious harm can result from electricity with relatively low voltages if a person is not adequately isolated (i.e. samples taken in a container can build static electricity, and therefore be a source of ignition unless the container is kept in contact with the filling nozzle).

Only those technicians that have been properly trained in electrical safety should work with or provide instruction regarding grounding and bonding methods.

9.7 Fire and Explosion Hazard Management

9.7.1 Introduction

Prevention is the greatest protection against damage by fires and explosions. Different operations will have different potential levels of risk and will require different levels of planning and control. Unplanned or uncontrolled explosions or fires that cause a serious injury, or have the potential of causing serious injury, must be reported to Alberta OHS. As such, Pieridae considers any fire or explosion on a Pieridae work site to be a major incident.

This section will cover:

- Training;
- The expanded fire triangle;
- Fire and explosion hazard assessment;
- Fire and explosion prevention procedures;
- Critical risk factors and control considerations;
- Fire safety plans;
- Firefighting classes and firefighting equipment;
- Firefighting procedures; and
- Fire extinguisher inspections.

9.7.2 Training

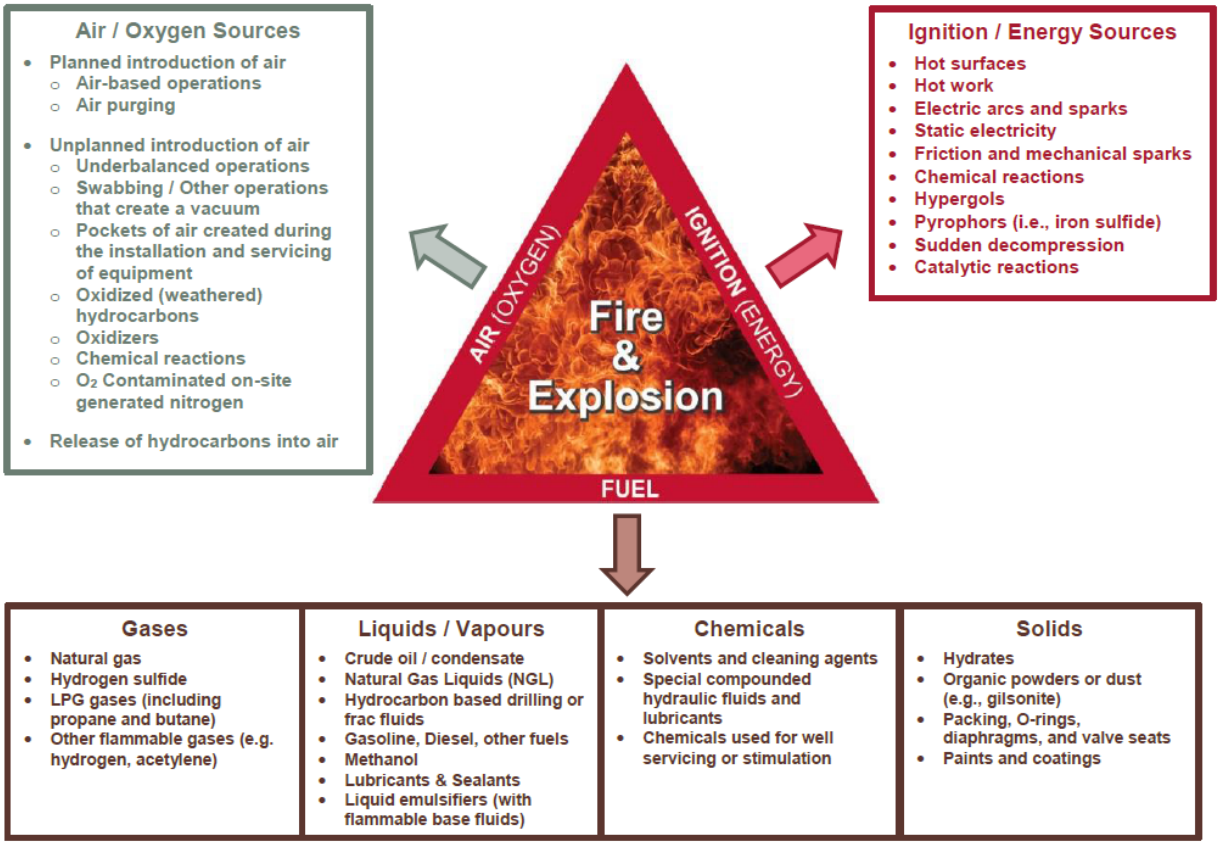
Refer to Section 4.6.2 Basic Fire Training.

9.7.3 The Expanded Fire Triangle

The fire triangle shows the three critical components required for combustion. A basic understanding of the fire triangle is important in identifying situations with the

potential to create a flammable or explosive mixture. Eliminating at least one of the sides of the triangle is essential to remove the potential for a fire or explosion.

It is also important to remember that even if all sides of the fire triangle co-exist, a resulting fire or explosion may not occur. The probability of ignition rises and falls based on a number of factors. An operation cannot be assumed to be safe on the basis that it has not led to a fire or explosion in the past.



9.7.4 Fire and Explosion Hazard Assessment

Fire and explosion hazards will be assessed both at the planning and field levels.

Identifying fuel-hydrocarbon, oxygen-air, and energy-ignition sources using the expanded fire triangle is a necessary first step in assessing potential fire and explosion hazards.

The level of assessment and management will depend on the scope and nature of the operations and the hazards. A field level assessment may be sufficient in cases where the hazards are obvious and controls well known, understood and applied. However, where hazards are less obvious and operations complex, a more robust, formal hazard assessment process and site specific procedure may be required.

Operations that require attention due to increased risks include but are not limited to:

- Where oxygen-air or oxidizing chemicals are purposely used as part of the planned operations, particularly where high pressure or hydrocarbon liquids are present;
- Where oxygen-air is likely to or can inadvertently enter a “closed” system;
- Where there is a significant possibility that hydrocarbons or other explosive mixtures may be released into the worksite (planned or unplanned); and
- Where an energy-ignition source is introduced into a potentially hazardous area.

9.7.5 Fire and Explosion Prevention Procedures

When fire and explosion is identified as a hazard associated with a work site or task (i.e. through job hazard analysis, safe work permitting, or drilling and completions safety meetings), written procedures to summarize the hazards and control measures necessary to manage the risk of fire and explosion associated with a work site or task should be developed.

In Alberta, with respect to drilling and completions operations, procedures are required to be in the form of a Fire and Explosion Prevention Plan that includes a description of the work to be done; a list of sources that contribute to fire and explosion hazards (fuel-hydrocarbon sources, oxygen-air sources, energy-ignition sources); a list of required controls; confirmation that workers have been trained to recognize potential fire and explosion hazards related to the planned activities, and are informed about site-specific prevention plans; and a reference to emergency plans and procedures.

A Fire and Explosion Prevention Plan template is provided. Refer to Appendix 1, Form 07 – Fire and Explosion Prevention Plan. The form contains structure and guidance on identifying fire and explosion hazards and controls and may be used to satisfy other provincial requirements to develop safe work procedures for fire and explosive hazards in the workplace.

A Fire and Explosion Prevention Plan may be used to assist in the development of a site specific procedure for an entire work site or it may be specific to a particular task or job.

A Fire and Explosion Prevention Plan should be completed by the Pieridae work site supervisor for operations that have an increased potential for fire and explosion. The following list of operations illustrate when a Fire and Explosion Prevention Plan may be required:

Well Construction

- Where oxygen-air or oxidizing chemicals are purposely used or inadvertently

introduced in well drilling and servicing operations.

- All snubbing applications.
- All well workover applications using hydrocarbon-based fluids.

Related Production Operations

- Planning and execution of an abnormal operation such as a facility turn-around or maintenance activity.
- Start-up of new equipment.
- Introduction of new chemical.
- Preparation and/or cleaning of tanks and vessels (i.e. confined space entry).

Repair and Maintenance Activities

- Modification of vessels, equipment, piping, pipelines that have contained hydrocarbons (i.e. hot work).
- All operations involving the use of propane torches to heat or thaw systems containing hydrocarbons.

Trucking Operations

- All tank truck repairs and maintenance.
- All vacuum truck operations involving the removal of hydrocarbon fluids.

The completed Fire and Explosion Prevention Plan will be dated, reviewed, revised when necessary, kept where the work occurs, and made available to workers.

9.7.6 Critical Risk Factors and Control Considerations

Just as the expanded fire triangle can serve as a tool to identify fire and explosion hazard sources, it can also work to identify effective controls for those same hazards. A control that removes or mitigates a hazardous fuel-hydrocarbon, air-oxygen, or ignition source will reduce the risk of a fire or explosion event.

The factors identified in the following table have a critical effect on fire and explosion and require careful consideration when assessing fire and explosion hazards and preparing fire and explosion prevention plans. General considerations are provided to assist in developing operation specific control measures.

Presence of liquid hydrocarbons and other flammable liquids	• Displacing highly flammable hydrocarbon liquids with air is not a recommended practice. • Liquid hydrocarbons in general (both light hydrocarbons such as condensates and heavy hydrocarbon liquids) represent a significant risk as they, in contact with oxygen, form oxidized hydrocarbons which may be highly unstable. • There is a potential for liquids to exist in an aerosol form. This significantly increases volatility and the potential for ignition by low-grade ignition sources (i.e. static electricity). • There is an increased potential for the build-up of significant static charges. Hydrocarbons are an insulating fluid; they have very low electrical conductivity. As they flow through piping and into tanks and tank trucks, they can cause the build-up of electric

	charges. These types of static build-up only dissipate slowly over time. • Monitoring equipment is calibrated to detect specific substances, typically natural gas (mainly methane). A monitor calibrated for methane will be inaccurate if used to detect atomized liquid hydrocarbons, liquid hydrocarbon vapors, or other fuels.
Presence of hydrogen sulphide (H_2S)	• Any H_2S containing stream can, in a reducing environment, cause the formation of iron sulfide from iron oxides. Iron sulfide is pyrophoric and will react with oxygen if available. Air or oxygen containing streams should not be introduced into these systems until the potential for a reaction has been removed. Refer to Section 9.3.5 Iron Sulphide Fires.
Addition of hydrocarbon-based drilling, completions, and workover fluids	• The potential for liquids to exist in an aerosol form, which significantly increases volatility and the potential for ignition by low-grade sources (i.e. static electricity). • Air-hydrocarbon contact (i.e. liquid hydrocarbons stored at atmospheric temperature and pressures) can result in the absorption of air and the formation or oxidized hydrocarbons, such as hydroperoxides, aldehydes, ketones, etc. Increased temperatures and pressures may decompose some of these highly unstable, explosive compounds (such as hydroperoxides) causing auto-ignition. • The use of air or oxidizing chemicals in the presence of liquid hydrocarbons can create a significant hazard.
Fluid mixtures with different chemical properties	• Mixing fluids with different chemical properties, such as solvents and chemical additives, can result in unique fluids with significantly different properties than either of the original fluids. Ensure monitoring equipment is calibrated to detect the appropriate hydrocarbon.
Elevated operating pressures and temperatures	• Monitoring equipment is calibrated to operate at specific temperatures and pressures. It will be inaccurate if the temperatures and pressures change. The monitoring equipment should be recalibrated if the operating conditions change in such a way that the equipment is operating outside of its specified limits.
Potential for rapid pressure or temperature changes	• Work procedures are required to ensure that any changes in pressure or temperature are managed (for example, when equalizing pressure between tubing and casing or between the wellbore and servicing equipment). • Temperature changes affect fluid properties. For example, increasing temperatures can cause a liquid to vaporize and overload the gas handling capability of a system. Decreases can cause a liquid to solidify or form a slush that affects fluid handling systems. • Consideration should be given to controlling the rate of temperature and pressure changes in the operation. This will eliminate or reduce the potential of fires or explosions due to adiabatic effects (increasing temperature as gasses are compressed) or increased volatility due to temperature increase.
Flowing explosive mixtures into “closed” systems	• The flowback of potentially explosive mixtures into closed systems that have not been purged or inerted is highly dangerous (i.e. P-tank, pressure vessel, connecting piping, flare stack) and is not a recommended practice. This can result in the ignition of the fuel/air mixtures from the flare or other ignition sources and the development of a potential explosive force. Some equipment may need to be redesigned to enable effective purging or inerting. • The introduction or injection of air into closed systems where it will mix with hydrocarbons, particularly liquid hydrocarbons is not a recommended practice. In drilling operations, as a minimum it should be restricted to operations where the well can be safely vented into an open system which does not have a pressure drop/does not restrict the flow of gas or liquid (i.e. into an open tank or drilling sump).
Pre-existing trapped air	• If the possibility exists that air was purposely or inadvertently introduced into the wellbore or other system during a previous or ongoing operation, the well or other system should be inerted or purged where possible. In a low pressure, dry-formation well, flowback could be considered a form of purging. If purging is not possible, specific plans will need to be developed.

	• Wells should be purged as soon as possible at the lowest flow, pressure, and temperature conditions possible. • Purging requirements for surface equipment depend on equipment design, the substances being purged, and the purge medium. • For surface piping systems refer to the following guidelines/standards for developing safe purging procedures: American Gas Association publication AGAXK0101: Purging Principles and Practice; NFPA 56: Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems; and/or NFPA 54/ANSI Z223.1: National Fuel Gas Code

9.7.7 Fire Safety Plans

At Pieridae field work sites the fire safety plan forms part of the site specific emergency phone list. For Pieridae office work sites, workers will follow the building fire safety plan.

Fire and explosion prevention procedures are intended to eliminate or reduce the risk of fire or explosion; however, it is also important to be prepared to safely handle an actual fire or explosion event. Provincial occupational health and safety legislation and/or fire codes require the development of written Fire Safety Plans for **occupied** work sites to provide safety of all workers in the event of a fire. Fire Safety Plans may include:

- Emergency procedures to be used in case of fire, including: sounding the fire alarm; notifying the fire department; and evacuating endangered workers, with special provisions for workers with disabilities;
- Quantities, locations and storage methods of all flammable substances present at the work site;
- Fire detection and suppression systems, including maintenance and testing requirements;
- Designation of persons to carry out the fire safety plan and the duties of the designated persons;
- Training of designated persons and workers in their responsibilities for fire safety; and
- Conducting fire drills.

9.7.8 Fire Classes and Fire Fighting Equipment

At the planning, construction, and implementation stages of any job, adequate firefighting procedures and equipment must be planned for and installed.

Fire extinguishing equipment is labeled according to the class of fire it best extinguishes. Fires are divided into four classes based on fuel type (i.e. the material that is burning).

- **Class A – Regular Combustibles** - This class includes organic fuels such as wood, paper, straw, and cloth. Combustible materials have a flash point above 37°C.

- **Class B – Flammable Liquids, Greases, Gases** - This class includes fuels such as gas, fuel oils, greases, varnish, tar, wax, ether, alcohol, and some plastics (including substances that liquefy upon being heated). Flammable materials have a flash point below 37°C.
- **Class C – Electrical** - This class includes all materials in areas where electrical voltage is still live such as near transformers, circuit breakers, remote signaling apparatus motors, and generators. After the power is shut off, the fire is class A, B, or D, depending on the materials involved.
- **Class D – Metals** - This class includes metals such as lithium, sodium, potassium, magnesium, and certain aluminum alloys.

9.7.9 Fire Fighting Procedures

Before any attempt to extinguish a fire, the following steps should be considered:

- Sound the alarm;
- Ensure the proper class and size of extinguisher is available for use;
- Determine that the fire is of appropriate size to be extinguished by a handheld extinguisher; and
- The fire should only be attempted to be extinguished by a worker who is both trained and willing to use the extinguisher.

9.7.10 Fire Extinguisher Inspections

Fire extinguishers should be inspected monthly and must be maintained annually by a qualified fire equipment maintenance company. Refer to Section 7.2 Regular HSE Inspections. Tags showing date of maintenance service must be affixed to each extinguisher.

A typical monthly inspection should include the following:

- Pressure gauge indicates “full” or it is within the green range (if applicable). CO_2 cylinders must be weighed to ensure they are full (weight is stamped on the extinguisher). If not at full weight, take out of service and send for maintenance. External Cartridge Dry Chemical extinguishers must have PIN indicator checked to ensure the extinguisher has not been charged. If PIN indicator has “popped up” (i.e. the extinguisher has been charged), take out of service and send the extinguisher in for maintenance.
- Visual inspection for dents and scratches of surmountable depth (i.e. that could affect the integrity of the cylinder) and loose connections of hoses, etc.
- Check the tag for the last date of maintenance and when it is due. The inspection should be recorded on the tag and/or on the Monthly HSE Inspection Checklist.

9.8 First Aid

9.8.1 Introduction

This section describes basic first aid responsibilities and requirements for Alberta and BC. It is not intended to be a comprehensive listing of first aid procedures; rather it will outline and provide "reminders" to support the First Aid/CPR training that operations personnel receive.

This section includes:

- Definitions;
- Responsibilities;
- Training;
- First aid requirements for a high hazard site;
- Records;
- Scene survey;
- Artificial respiration;
- Bleeding;
- Burns;
- Cardio-pulmonary resuscitation;
- Cold environments;
- Hypothermia;
- Heat illness;
- Cold weather clothing;
- Heat Illness; and
- Chemical spills.

9.8.2 Definitions

First Aid

- The immediate and temporary care given to an injured or ill person at a work site using available equipment, supplies, facilities or services including treatment to sustain life, to prevent a condition from becoming worse or to promote recovery.

First Aider

- A person who is designated by an employer to provide first aid to workers at a work site and who is qualified/certified to provide first aid as per provincial OHS regulations.

Training Agency/Provider

- A person or organization that delivers first aid training courses and cardiopulmonary resuscitation training courses that is acceptable to the

provincial Director.

Close Work Site

- In Alberta, a work site that is not more than 20 minutes travel time from the nearest health care facility under normal travel conditions using the available method of transportation.

Distant Work Site

- In Alberta, a work site that is more than 20 minutes travel time, but less than 40 minutes travel time to the nearest health care facility under normal travel conditions using the available means of transportation.

Isolated Work Site

- In Alberta, a work site that is more than 40 minutes travel to the nearest health care facility under normal travel conditions using the available means of transportation.

9.8.3 Responsibilities

All injuries, no matter how minor, must be reported to the work site supervisor immediately.

Employer

- All work sites will have first aid services available and will maintain, for all workers, a first aid room (if required), first aid equipment and supplies. First Aid supplies should be checked monthly as part of the HSE Inspection Report. These services, rooms, and supplies and equipment must be accessible during all working hours. Equipment and supplies must be kept dry, serviceable and contained within material that protects the contents from the environment. First aid equipment and supplies must be inspected regularly.
- The equipment must be clearly identified as first aid equipment and supplies and at appropriate areas around the work site there must be signs indicating the location of the first aid equipment and supplies. If posting signs is not practical, the work site supervisor is responsible to ensure that each worker knows the location of the first equipment and supplies.

First Aider

- In the event of an emergency, first aiders should not be concerned about legal liability in rendering aid as the Good Samaritan laws are accepted throughout Canada. First aiders must do the following:
  - Consent should be obtained prior to rendering aid. When dealing with an unconscious victim, the law assumes that these casualties would consent to aid if they could. This is implied consent.
  - First aiders must not abandon their casualties. Continue with care until a more experienced person arrives.
  - First aiders must use common sense when rendering aid. Apply only the skills that you have been trained to administer.
  - Treat at the scene of the accident. Never unnecessarily move a victim.

9.8.4 Training

All Pieridae employees directly involved with field operations must be trained in First Aid/CPR. Refer to Section 4.5.4 First Aid/CPR.

- Each work site will have properly trained first aiders.

9.8.5 Service and Equipment Requirements

The level of first aid service as well as the type and quantity of equipment required at a work site depends upon a number of factors such as:

- The provincial jurisdiction,
- The number of workers who may require first aid at any time,
- The nature and extent of the risks and hazards in the workplace,
- The types of injuries likely to occur,
- Any barriers to first aid being provided to an injured worker, and
- The time that may be required to obtain transportation and to transport an injured worker to medical treatment.

Minimum first aid requirements are prescribed by provincial OHS regulations based on the occupational hazard or risk of the work site. Oil and gas drilling, servicing and production is characterized as high hazard work by provincial OHS regulations. For information regarding first aid kit contents please refer to provincial jurisdiction OHS regulations.

9.8.6 Alberta First Aid Requirements for Low Hazard Work (Pieridae Office Locations)

Number of Workers per work site per Shift	**Close Work Site < 20 minutes**
1	Type P Kit
2-9	No. 1 First Aid Kit
10-49	1 emergency first aider No. 1 Kit
50-99	1 emergency first aider 1 standard first aider No. 2 Kit
100-199	1 emergency first aider 2 standard first aiders No. 3 Kit Designated area for first aid services
200 or more	1 emergency first aider 2 standard first aiders Plus 1 standard first aider for each additional increment of 1 to 100 workers No. 3 Kit Designated area for first aid services

9.8.7 Alberta First Aid Requirements for a High Hazard Site

Number of Workers per work site per Shift	Close Work Site Up to 20 minutes to hospital	Distant Work Site 20 minutes to 40 minutes to hospital	Isolated Work Site More than 40 minutes to hospital
1	Type P Kit	Type P Kit	Type P Kit
2-4	1 emergency first aider No. 1 First Aid Kit	1 standard first aider 3 blankets No. 2 Kit	1 standard first aider 3 blankets No. 2 Kit
5-9	1 emergency first aider 1 standard first aider No. 2 Kit	2 standard first aiders No. 2 Kit 3 blankets	2 standard first aiders No. 2 Kit 3 blankets
10-19	1 emergency first aider 1 standard first aider No. 2 Kit & 3 blankets	2 standard first aiders No. 3 Kit & 3 blankets, stretcher and splints	2 standard first aiders No. 3 Kit & 3 blankets, stretcher and splints
20-49	2 emergency first aiders 1 standard first aiders No. 2 Kit & 3 blankets	3 standard first aiders No. 3 Kit & 3 blankets stretcher and splints	3 standard first aiders No. 3 Kit & 3 blankets stretcher and splints
50-99	2 emergency first aiders 2 standard first aiders No. 3 First Aid Kit 3 blankets	2 emergency first aiders 2 standard first aiders No. 3 First Aid Kit 3 blankets, stretcher and splints	4 standard first aiders 1 advanced first aider No. 3 First Aid Kit 3 blankets, stretcher and splints
100+ Refer to OHS Code and Schedules			

9.8.8 BC Requirements

Refer to regulations.

9.8.9 Records

Every injury must be reported using an Incident Report and appropriate WCB forms (if applicable, for employees). Refer to Appendix 1, Form 11a - Incident Report.

- Records must be maintained on file for three years.
- Access to records is restricted to individuals requiring information for the purpose and disclosure of the information with regard to an investigation, medical treatment or work site inspections.

9.8.10 Scene Survey

If an injured person is encountered:

- Send or call for help.
- Assess potential hazards at the scene. Although the emphasis is on care of the victim, be sure to assess the area for hazards. The most important person at the scene is you, the rescuer!
- Start first aid immediately, even if the victim does not appear to be alive. If there is more than one victim administer life saving first aid only.
  - Airway – ensure a clear airway (head tilt, chin lift).
  - Breathing – ensure effective breathing (if pulse, artificial respiration).
  - Circulation – ensure effective circulation (if no pulse, CPR).
  - Try to determine what happened (history, signs around you, symptoms of the victim).

Following first aid, it is important to keep the victim in the best possible condition until medical help arrives (i.e. do not move the victim unless required to prevent further injuries, recovery position, keep the victim warm and calm to help prevent shock, do not abandon the victim, etc.).

9.8.11 Bloodborne Pathogens

Exposure to bloodborne pathogens (such as Hepatitis B, Hepatitis C and HIV) would most likely occur when providing first aid to an injured worker. Exposure can also occur through contact with an object that has been contaminated by an infected person (i.e. broken glass, needles/sharps) and through exposure to bodily fluids other than blood such as saliva, urine feces. Sharps/needles shall be disposed of in proper receptacles and latex gloves should be used when providing first aid.

9.8.12 Working in Cold Environments

When determining the ambient temperature on a cold day, a number of factors need to be considered. If the outside temperature is recorded at - 23º Celsius, consideration must be given to the wind speed. If at the time the wind speed is 18 km/h then the chill factor is really -36º Celsius. Always consider wind and temperature together.

Exposure to cold weather conditions cannot be totally avoided. However certain precautions can be taken which will reduce the risk of cold weather injury:

- Avoid alcohol, as it can affect circulation especially extremities (ears, nose, toes, and fingers). (Note: alcohol is not permitted on Pieridae work sites).
- Pre-existing health conditions may affect body temperature, regulation or circulation. Such conditions should be reported to the work site supervisor (e.g. white finger disease, diabetes, or others).
- For those individuals that have had frostbite, those parts will be most sensitive to be frostbitten again.

- If you wear loose, bulky clothes, be sure it is not going to affect you in your work with equipment or machinery.
- A diet high in fats and carbohydrates may help maintain body temperatures (i.e., pasta, rice, potatoes, dairy, nuts, and fat meat.).
- Drink lots of fluids to replace fluid lost through breathing and perspiration as dehydration increases the risk of hypothermia.

9.8.13 Hypothermia

The most hazardous effect of cold weather is hypothermia. Hypothermia is a condition where the body's temperature drops below 37º Celsius. This can cause a worker to become disorientated, less alert, and less attentive to the job at hand. It can also result in death. Hypothermia may be brought on by lack of suitable clothing, wet windy environments, falling in cold water, or any situation in which the body cannot maintain its core temperature. To prevent the onset of hypothermia, adequate warm clothing is to be worn in several loose layers. The greatest heat loss to the body occurs through the head and neck area, particular attention is to be given to protecting these areas in cold weather. Hard hat liners and high collar outerwear should be worn in winter months. Unfortunately, workers affected by hypothermia may be unaware of their condition and may even resist help. If a worker is suspected to be suffering from hypothermia, aid should be given even if it is refused.

The symptoms and effects of hypothermia occur in the following order:

- Shivering;
- Slowing of the heart and breathing;
- Loss of coordination;
- Lack of organ functions (i.e. kidneys);
- Disorientation; and
- Stopping of the heart (death).

If a worker is suffering from hypothermia, the following treatment should be administered:

- Send for help;
- If necessary, artificial respiration is to be administered, but NOT heart massage (CPR), this could cause heart failure or fibrillation;
- Move the victim to a warm room or shelter carefully. Rough handling could also cause heart failure;
- If wet, remove the wet clothing and gently towel the victim dry;
- Warm the victim by applying hot water bottles or towels soaked in water to the neck, arm pits, and inside thighs. If these methods are not possible, one or two persons can lie in close contact with the victim to provide the necessary warmth;

- Keep the victim awake until examination by medical personnel; and
- Give sweets to the victim as a quick energy source.

There are numerous treatments that must NOT be administered to victims of hypothermia such as:

- DO NOT give victims alcohol or hot liquids to drink until the victim has completely re-warmed;
- DO NOT immerse the victim in a hot bath. This must only be done by qualified medical personnel;
- DO NOT massage the victim to warm them; and
- DO NOT cover or wrap the victim, unless the victim is being warmed by a heat source under the wrap such as another person, hot water bottles or hot towels.

9.8.14 Cold Weather Clothing

Cold weather work garments should be comfortable, durable, weatherproof, as well as highly visible. Additionally, the outer layer must be fire retardant when working on Pieridae work sites. Wool or cotton should be worn under fire retardant clothing to protect during a flash fire (i.e. synthetic materials can melt to the skin).

The most effective cold weather garment is the three (3) layer clothing system:

Layer No. 1

- Long underwear of wool (if working in flammable environments) or chlorofibre as it absorbs body moisture, and keeps it away from skin.

Layer No. 2

- Wool and synthetic, insulated or down, keeping a layer of air trapped, around the body.

Layer No. 3

- Covering to protect Layer No.2 from dust, dirt, wind, and moisture, and must be removable to prevent the build up of body heat.

Cotton-twill is preferred because it is water and wind proof, whereas nylon and synthetics can develop static charges. Proper head and footwear are essential and mittens should have removable insulated liners. If you cannot remove liners they gradually absorb moisture that is almost undetectable. This speeds up the loss of body heat. Boots insulated with a removable insole, and worn with wool or nylon blend socks are recommended.

9.8.15 Working in the Heat

Working in hot weather with fire retardant clothing can cause heat stress. The following are examples of conditions to be aware of and to prevent:

Heat Cramps

This condition is caused by the body's inability to maintain a normal temperature of 37º Celsius, long exposure to hot conditions, overexposure to the sun, lack of fluids to replace lost body fluids, vigorous exercise or hard labor in hot environments. Symptoms include:

- Excessive sweating; and
- Painful muscle cramps in the legs and abdomen.

To treat heat cramps:

- Place the victim in a cool place to rest;
- Give a glass of slightly salted water to drink (a couple teaspoons to a litre of water);
- Give another glass in 15 minutes; and
- If the cramps persist, do not give any more water, seek medical attention immediately.

Heat Exhaustion

This condition is more serious than heat cramps. It occurs when excessive sweating causes a loss of body fluids and when a hot environment and high humidity do not allow the body to cool by sweating. Symptoms include:

- Excessive sweating;
- Cold, clammy, pale skin;
- Weak and rapid pulse;
- Vomiting;
- Blurred vision;
- Painful cramps in legs and abdomen; and
- Headache.

To treat heat exhaustion:

- Place the victim at rest in a cool place;
- Remove excessive clothing;
- Loosen tight clothing;
- Give slightly salted water as much as the victim will take; and
- Continue care until medical help arrives.

Heat Stroke

This condition is life threatening. It occurs when the body's temperature control fails or as a result of heavy physical exertion in high temperature. Symptoms include:

- Body temperature rises to 40°C and above;

- Rapid, full pulse, becoming weaker in later stages;
- Flushed, hot, dry skin;
- Noisy breathing; and
- Restlessness, convulsions, vomiting, unconsciousness.

To treat heat stroke:

- Move the victim to a cool place;
- Ensure airway and breathing are adequate;
- Remove clothing;
- Immerse in a cool bath or sponge with cool water particularly in the groin, armpit and neck areas;
- When the body feels cooler to the touch, cover with a dry sheet and fan the victim;
- If the victim's temperature begins to rise again, repeat the procedure above; and
- Seek medical attention immediately.

9.9 Fit for Work - Fatigue Management

9.9.1 Introduction to Fatigue

Fatigue is a feeling of tiredness or exhaustion that comes from physical or mental exertion; it is a message to the body to rest. It can be aggravated by acute lack of sleep or an accumulated sleep debt. It causes slower reaction and can result in poor decisions, more mistakes, decreased performance, and dangerous lapses from microsleeps and automatic behavior.

Fatigue is a potential hazard to overall health and safety at the work site. Workers who are fatigued can present a hazard to themselves and others. Pieridae's objective is that all workers recognize the threat of fatigue and manage the associated risks by:

- Arriving at work fit for duty
- Managing lifestyle to minimize fatigue with adequate sleep
- Reporting all fatigue-related near misses and incidents
- Maintaining an awareness of fatigue
- Supporting and participating in fatigue mitigation strategies
- Stopping work when the activities are unsafe due to fatigue. (Refer to Section 6.1.2 Right and Obligation to Refuse.)

9.9.2 Recognizing Fatigue

Fatigue can be recognized by the following hazardous conditions, effects or behaviors:

- Inability to sleep;
- Slower reflexes and reactions;
- Microsleeps (up to 60 seconds where the brain goes to sleep and worker blacks out no matter what they are doing);
- Automatic behavior (where worker does routine tasks but is not having any conscious thoughts);
- Inability to make good decisions or plans;
- Inability to solve problems;
- Inability to concentrate, including wandering thoughts;
- Decreased alertness and watchfulness;
- Inability to remember things just done, seen or heard;
- Inability to notice the things the worker usually would notice;
- More mistakes that usual;
- Failure to respond to changes in surrounding or situation;
- Poor logic and judgment, including taking risks a worker would not usually take;
- Inability to communicate well;
- Inability to handle stress;
- Inability to see properly; and
- Moodiness.

Workers and supervisors are required to understand these potential impacts to be able to recognize when they or others are fatigued. When fatigue is identified, it should be reported using the hazard alert/near miss report. Refer to Appendix 1, Form 09 – Hazard Alert/Near Miss Report.

Workers should consciously self-monitor for signs of fatigue. When a worker is fatigued, this should be reported to the supervisor. The work site supervisor will ensure appropriate preventative actions are implemented. If it is determined that a worker is not fit for work, the work should not commence the shift and appropriate corrective actions should be implemented.

9.9.3 Assessing and Mitigating Fatigue

When assessing a task for fatigue, the following factors should be considered:

- Work schedule – some work schedules may not provide sufficient sleep opportunity for workers resulting in increased risk of fatigue.
- Work task – some tasks may be more likely to cause fatigue or induce fatigue

related errors. Activities with a high physically demanding workload and/or mentally demanding processes may result in higher levels of fatigue.

- Workplace conditions – elements of the work environment can promote or reduce alertness. Conditions to consider that may contribute to drowsiness include low lighting, high noise levels, hot or cold temperatures, poor ventilation, cumbersome PPE, and poor ergonomic design of workspace.
- Worker health – worker's with conditions such as depression, diabetes, hypertension, sleep disorders or short-term illness like colds or allergies can be more easily fatigued. Over-the-counter or prescription medication can also affect fatigue.
- Worker stress – a stressed worker can be more vulnerable to fatigue (whether it is due to issues at work or at home).

Fatigue is a potential hazard to overall health and safety at the work site. Workers who are fatigued can present a hazard to themselves and others. In general, the following measures should be considered for work and work site conditions to manage fatigue:

- Create a work environment that promotes alertness;
- Implement engineering and administrative controls to avoid or greatly reduce exposure;
- Ensure sufficient resources of personnel, equipment and support;
- Structure hour of work to avoid the hottest or coldest periods of the day;
- Provide additional fluid and/or nourishment;
- Adjust time factors to incorporate the additional physical requirements and challenging environmental and physical conditions;
- Select personal protective equipment appropriate to the situation and/or condition that exists and limit the duration of tasks that affect performance or that place additional physical demands on the worker.
- Design or select equipment that is engineered for ease of use with minimal opportunity for error or misuse.
- Provide facilities for naps. Naps of about ten minutes in duration can have positive effects on alertness and performance. Time should be provided after the nap to recover from grogginess or sleep inertia that may occur.
- Provide appropriate worker accommodations (hotels, camps, etc.)
- Use proper schedule to ensure adequate rest.
- Minimize travel time between camps and workplaces.
- Provide transportation support for workers that may leave their shift tired.
- Encourage workers to eat healthy, drink water to avoid dehydration, and use caffeine in moderation a few hours before sleeping.

Specific measures to address fatigue include:

- Workers are expected to conduct their affairs off the job in such a manner that they report for work each day in a condition that enables them to do their work

safely.

- Workers taking prescription drugs that can cause drowsiness or affect work efficiency must inform their work site supervisor.
- Work site supervisors will manage schedules and shift work to be efficient, effective and appealing.
- Safe driving and travel should be treated as regular work time in terms of fatigue management and rest breaks, nutrition breaks and physical activity should be considered.
- Taxing environments such as outdoors in the cold or heat, being away from home for long periods of time and the need to wear certain personal protective equipment such as respirators or heavy clothing can contribute to fatigue and should be considered by the worker and work site supervisor and managed accordingly.

9.9.4 Reporting Fatigue

Fatigue should be reported using the hazard alert/near miss report or incident report procedure. Refer to Appendix 1, Form 09 – Hazard Alert/Near Miss Report. Additionally, incident investigation should evaluate the potential of fatigue as being a contributing factor to an incident.

- Fatigue must be considered to perform work safely and workers who are fatigued may refuse to do work using the procedure outlined in Section 6.1.2 Right to Refuse.

Work site supervisors must consider fatigue as a possible hazard and if worker fatigue is recognized steps must be taken to ensure the work can be done safely.

- How many hours did the employee work in the past week?
- What is the pattern of hours worked in the past week?
- Is the employee suffering from acute sleep loss?
- Does the employee have a sleep debt?
- Is the employee required to work at a time out of sync with the waking cycle of the employee's circadian rhythm?
- Do environmental factors pose an additional fatigue load?
- Does the employee's condition match the mental, physical, and emotional demands of the work?
- What is the physical intensity of the work?
- Does the employee's physical fitness match the work demands?
- What events are currently going on away from work? Is the employee experiencing life stressors?
- How well has the employee coped in the past?
- Does the employee get support at work and at home?

9.10 Fit for Work – Alcohol, Cannabis and Drug Policy and Procedure

9.10.1 Introduction to Alcohol and Drug Policy and Procedure

The purpose of this procedure is to provide a safe and healthy work environment that reduces effects due to the use of alcohol or drugs and respects the privacy of individuals. Prevention is the foundation of this policy and it is applicable to Pieridae workers.

Alcohol is an intoxicating agent in beverage alcohol, ethyl alcohol or other low molecular weight alcohols including methyl or isopropyl alcohol. Results of a breath alcohol analysis are expressed in terms of weight to volume, weight of alcohol (expressed in grams) per volume of breath (210 litres). Evidential Breath Alcohol Testing Devices screen at the 0.020 level.

Drugs are any substance other than food which is taken to change the way the body or mind functions. Drug testing refers to marijuana/cannabis, cocaine, opiates, phencyclidine and amphetamines with cutoff levels as per the Substance Abuse and Mental health Services Administration of the Depart of Health and Human Services which is the certifying agency for forensic urine drug testing laboratories in Canada.

9.10.2 Alcohol and Drug Policy Scope, Rules and Reporting

Workers are expected to be fit for work and to perform their job or contracted duties in a safe manner and in all ways consistent with Pieridae policies and procedures. Pieridae expects all employees and contractors to assist in maintaining such a working environment.

The use of alcohol or drugs may be viewed as a breach of contract. Disciplinary action may be taken, up to and including termination of employment or contract for cause. The responsibility for successfully implementing the policy is shared by Pieridae, each employee, and each contractor.

Rules that specifically apply to alcohol and drugs include:

- Possession, use or offering for sale of drugs or drug paraphernalia while working for Pieridae is prohibited.
- Workers shall not report for work or remain at work if they are under the influence of alcohol or drugs (including prescribed substances). A supervisor suspecting that a worker is under the influence of alcohol or drugs shall not permit the worker to perform or continue to perform work.
- Workers required to take a post-incident alcohol or drug test shall not use alcohol or drugs for eight hours following the incident, or until the post-incident testing occurs, whichever occurs first.
- Workers will not misuse prescription or over the counter medications in such a manner as to render themselves unfit to safely perform work. It is expected that the worker will consult their medical practitioner if there are any side effects to prescribed substances. If there is a concern, the worker must advise

the supervisor immediately. The circumstances will be considered and situation mitigated, where possible, with restricted work, modified duties or sick or disability leave.

- Workers are expected to cooperate with all testing in cases of pre-access, post-incident, reasonable concern, and follow-up testing. A worker who refuses to submit for required testing will not be permitted to perform or continue to work. A worker who refuses to submit to a required test, tampers with or attempts to tamper with a test sample or obstructs the testing process may be subject to disciplinary action up to and including termination of employment.
- Pieridae reserves the right to conduct searches of its own property as part of the overall focus on safety and prevention. Pieridae will work with Law Enforcement Authorities when violations of Canadian Law occur on Pieridae property or work sites.
- All drug and alcohol test results and information from Substance Abuse Professionals are confidential and will be maintained in a secure manner.

Concerns regarding drugs and alcohol for an individual worker or another worker should be addressed with a supervisor and information will remain anonymous.

9.10.3 Alcohol and Drug Testing

All testing will be conducted by certified professionals. On an as needed basis, Pieridae will contract the services of certified professionals to maintain the alcohol and drug testing procedure. The designated drug and alcohol testing company will follow federal guidelines and standards and information will be provided immediately before testing. The designated drug and alcohol and testing company will use the services of a Medical Review Officer who is a licensed physician and is knowledgeable about substance abuse problems and has skills in understanding medico-legal issues, policy development issues, clinical medicine and occupational medicine. There are five situations that may require testing:

- Pre-access: testing may occur to gain and or maintain access to Pieridae work sites.
- Post-incident: testing may occur within a designated time period after an incident.
- Reasonable concern: testing may occur where there is a concern that a worker is under the influence of drugs or alcohol. Observations which may lead to reasonable concern for testing include, but are not limited to: odor of alcoholic beverage on breath; slurred speech; glassy eyes; unsteadiness in walking, standing etc.; flushed face; disoriented and/or drowsy; indications or drug or alcohol use in the vicinity such as alcohol or drug containers, marijuana smoke smell, etc.; incidents or injuries; repeated errors in job performance; and frequent absenteeism or lateness.
- Follow-up: testing may occur as part of an ongoing rehabilitation program. This may include follow up on an unannounced basis for at least one year on return after a Substance Abuse Professional assessment identifies the need to resolve a problem with alcohol or drug use.

9.10.4 Positive Alcohol and Drug Test Results

In order for the alcohol and drug policy to be effective in ensuring that workers will perform their positions unaffected by alcohol or drugs, the provisions of this policy will be enforced. Accordingly, where the policy is violated the worker will be subject to corrective disciplinary action, as appropriate, up to and including termination of employment.

Pre-access tests that fail will not allow a worker to work. These individuals will be encouraged to seek assistance from a Substance Abuse Professional and will be advised that they can apply for future available positions.

Workers that have positive test results will be removed from duty immediately and will not be allowed to return to work until the results of the test have been reviewed by Pieridae. The worker may be required to undergo further testing prior to returning to work or may have to attend a meeting with management. Pieridae will review each case and provide information regarding resources available in evaluating and resolving problems with the use of alcohol or drugs including the names, addresses and telephone numbers of Substance Abuse Professionals. Where practical, management will endeavor to meet or contact the worker the next working day and direction will be provided regarding the suspension and return to work choices. All actions be managed and documented in a confidential manner.

Following a positive test result, follow-up testing may be done to monitor a returning worker. The frequency of testing will be determined by Pieridae and will be designed to assist the individual in remaining alcohol or drug free at work.

9.11 Fit for Work - Mental Health in the Workplace

9.11.1 Introduction

Mental health problems are the leading cause of workplace disability in Canada; depression and anxiety disorders result in more workdays lost than any other medical condition. Stress and mental health issues can also contribute to increased risk for physical illnesses including coronary heart disease, stroke, and diabetes.

Mental health problems include both psychological distress (relatively brief periods of stress related to difficult circumstances) as well as mental illnesses (changes in thinking, mood, or behavior associated with considerable suffering and impaired functioning over an extended period of time). The most common mental illnesses include anxiety (i.e. generalized anxiety disorder), affective disorders (i.e. major depressive episode), and substance use disorders (i.e. alcohol or drug abuse). It is important to distinguish between psychological distress and mental illness in order to avoid pathologizing normal emotional responses and to avoid trivializing the challenges faced by people with mental illnesses. Every year, approximately

one in five Canadian workers experience high psychological distress, and approximately one in ten Canadian workers deal with mental illness.

It is estimated that mental illness costs the Canadian economy $51 billion per year in terms of healthcare service use, lost workdays, and work disruptions. Understanding the human and financial costs of workplace mental illness helps employers develop action plans to improve employee well-being and save costs. It is the responsibility of both employers and employees to protect and promote mental health in the workplace.

9.11.2 Definitions

Mental well-being: a state in which a person realizes his or her own abilities, can cope with the normal challenges of life, can work productively, and is able to contribute to his or her community and workplace.

Psychological distress: temporary periods of stress, burnout, and/or anxiety related to specific situations, during which a person is still functioning normally at work or at home. Feeling stressed or anxious does not mean that a person has a mental illness; however, stress and anxiety may become a health problem if they persist for a long period of time.

Mental illness: changes in thinking, mood, and/or behavior that are out of character, cause a lot of distress, and make it difficult for a person to cope with daily tasks, leading to impaired functioning at work and/or at home. Mental illnesses result from complex interactions of biological, psychosocial, economic, and genetic factors. People of all ages, occupations, income levels, and cultures can be affected by mental illness. Symptoms of mental illness vary from mild to severe, depending on the type of mental illness, the person, and their environment. Factors in a person's environment may contribute to mental illness, such as stressful life conditions (e.g. financial problems, death in the family, divorce), chronic medical conditions (e.g. cancer), traumatic experiences (e.g. military combat, assault), and social isolation (e.g. having few healthy relationships). Mental illnesses can range from single short-lived episodes to chronic disorders. Common types of mental illness include mood disorders (e.g. depression, bipolar disorder), anxiety disorders (e.g. generalized anxiety disorder, obsessive-compulsive disorder), eating disorders (e.g. anorexia nervosa, bulimia), substance use disorders (e.g. alcohol or drug abuse), and schizophrenia.

Stigma: fear, blame, and misunderstanding regarding people with mental illnesses. Stigma adds to the suffering caused by mental illness. Stigma may stop people with mental illness from seeking help.

Psychologically healthy workplace: a workplace that promotes the emotional well-being of employees by maintaining a positive work environment and providing support to reduce the duration and severity of mental illnesses.

9.11.3 Signs and Symptoms of Mental Health Issues

Signs of stress (psychological distress) include:

- Struggling to perform tasks that used to be easy;
- Experiencing more frequent conflict when a person used to resolve differences easily;
- Feeling overwhelmed by repetitive thoughts about what was said or done; and
- Having feelings of apprehension or anxiety that won't easily go away;

Symptoms of mental illness vary in severity, frequency, and duration depending on the individual and their illness. Common symptoms of mental illness include:

- Major changes in eating or sleeping habits;
- Avoiding others and spending more time alone;
- Excessive fears, worries, and anxieties;
- Excessive anger or irritability;
- Excessive fluctuations in mood ("highs and lows");
- Confusion and indecision;
- Physical aches and pains with no obvious cause;
- Substance abuse;
- Having strange beliefs not based in reality (delusions);
- Hearing or seeing things that aren't there (hallucinations);
- Inability to cope with daily problems and activities; and
- Thoughts of self-harm or suicide.

Major Depressive Disorder is one of the most common mental illnesses. Symptoms of a Major Depressive Episode include at least one of the following:

- Significantly depressed mood; and
- Loss of interest or pleasure in activities.

Accompanied by at least four of the following:

- Changes in appetite or weight;
- Sleep disturbance or restlessness;
- Agitation or feeling slowed down;
- Fatigue;
- Feelings of worthlessness or guilt;
- Difficulty concentrating or making decisions; and
- Recurrent thoughts of death or suicidal ideation, plans, or attempts.

Normal feelings of stress or sadness should not be considered Major Depressive Episodes unless criteria are met for severity (5 out of 9 symptoms above), duration (symptoms persist for most of the day, nearly every day, for at least 2 weeks), and functional impairment (the condition is associated with significant distress or impairment in day-to-day functioning).

Generalized Anxiety Disorder is characterized by at least 6 months of persistent and excessive anxiety and worry (the intensity, duration, or frequency of anxiety is far out of proportion to the actual likelihood or impact of the feared event), accompanied by at least three of the following:

- Restlessness;
- Fatigue;
- Difficulty concentrating;
- Muscle tension; and
- Sleep disturbance.

Alcohol consumption may be an alcohol abuse disorder if a person's drinking falls into one (or more) of the following categories:

- High-risk drinking: drinking alcohol in amounts that exceed the low-risk recommendations in the national drinking guidelines.
- Alcohol abuse: drinking that repeatedly leads to legal problems, problems at work, school, or home, problems in social relationships, and/or risk-taking behavior while under the influence, over a 12-month period.
- Alcohol dependence: three or more of the following in a 12-month period; increased tolerance to the effects of alcohol, drinking more than intended, difficulty cutting down or controlling drinking, spending excessive amounts of time obtaining alcohol, drinking it, or recovering from its effects, missing important social, occupational, or recreational activities because of drinking, withdrawal symptoms when attempting to stop or cut down, and continuing to drink despite knowing about or suffering from its negative effects.

9.11.4 Employees with Mental Illness

Those that have experienced a mental illness, may have developed skills which will be valuable at work, such as: problem solving, tenacity, diplomacy, creativity, and the ability to relate to different sorts of people. These experiences can be used in resumes, job interviews, or in challenging job situations (workers do not have to refer to mental illness, just the skills developed as a result of it).

At some point, a worker may choose or find it necessary to disclose details about mental health history. Workers should think about the reasons for disclosing this information, and weigh the pros and cons. If seeking employment, will disclosing this information help obtain work? If currently employed, will disclosing this information mean that work can be managed without undue stress?

If workers feel overwhelmed by stress, anxiety, or depression or feel unable to cope with daily tasks, it is important to seek help. Various support is available. Contact occupational health and safety services, employee and family assistance programs, or take advantage of extended benefits coverage for mental health care. Workers should also seek help from a health care professional such as a family physician, a psychologist, a psychiatrist, or another mental health professional.

If a worker is in crisis and needs immediate assistance, go to the emergency department of the nearest hospital, dial 911, or call a 24/7 crisis line (go to your telephone directory and look under Crisis Centres to find the phone numbers).

9.11.5 Promoting Mental Health in the Workplace

Workplaces that promote mental well-being and encourage employees to maintain healthy lifestyles require strong leadership. Mental health promotion benefits everyone, whether the person is healthy, at risk for developing difficulties (such as a substance abuse problem), or has an existing mental health problem (such as depression). Mental health promotion is a holistic approach that focuses on the physical, mental, and emotional well-being of individuals, workplaces, families, and communities.

Best practices support early intervention. Early identification and treatment of mental health issues is important for an individual's recovery. Early intervention also benefits workplaces by reducing the number and cost of mental health disability claims and reducing the duration of employee absences. With appropriate support and treatment, most people who suffer from mental illness can and do recover.

Providing and maintaining a psychologically safe workplace has been recognized as a legal duty, similar to the duty to provide a physically safe workplace. Employers who create and sustain supportive work environments will attract and keep employees who are more engaged and enthusiastic, resulting in improved performance, increased productivity, and better long-term sustainability. There are also compelling financial incentives for employers to provide support for employee mental health: when businesses adopt policies and programs to address mental health, they see 15 - 30% lower costs, related to reduction in absenteeism, benefits costs, turnover, incidence of accidents and injuries, workers' compensation claims, and disability rates. The main challenge is to create an environment that encourages people to seek early treatment.

It is important to note that mental health problems range from mild difficulties on one end (low mood, sleep difficulties, excessive worry) to severe disorders on the other (schizophrenia, bipolar disorder, severe depression). Because milder health problems are far more common in the workplace, they account for a larger proportion of the negative impacts. Protecting psychological health must be the primary focus in order to reduce the level of less severe problems.

Workplace factors that contribute to the degree of stress perceived by employees include:

- Control: having some flexibility or choice regarding schedules, responsibilities, and the way work is done can significantly reduce employee stress levels.
- Demands: excessive workload can lead to increased stress, anxiety, and burnout.
- Support/Reward: encouragement, sponsorship, and resources provided by the organization can help reduce stress. This support includes peer and management support, workplace wellness programs, on-site corporate health or wellness clinics, and Employee Assistance Programs (EAPs).
- Relationships: limiting conflict and appropriately dealing with unacceptable behavior (e.g. bullying and harassment) helps reduce stress.
- Roles: clear definitions and expectations about workplace roles helps reduce stress and conflict between employees.

Employees who experience high demand, low control, high effort, and low reward in their daily work are more likely to suffer adverse psychological consequences such as stress or mental illness. In addition, employees are more likely to feel stress and anxiety in a toxic work environment where they are exposed to bullying, harassment, or violence. Refer to Section 9.35 Violence & Harassment Prevention.

A wide range of interventions can promote mental health, prevent stress, and help to develop resilience among employees. These interventions are required on both individual and organizational levels. Development and implementation of workplace wellness programs involve the following steps:

- Step 1: commit to creating a workplace that promotes mental well-being. It is essential to have strong senior leadership and meaningful involvement of leaders in the development of a mental health program.
- Step 2: include employees at all levels. Consult with employees and managers to identify strengths and weaknesses in the organization’s approach to mental health. Baseline data can be collected regarding employees' perception of the health of the organization and their departments, and the perceived levels of stress they experience in their roles.
- Step 3: set program objectives and targets. Program objectives and targets should be established before the program is launched. Areas to monitor include employee awareness of the program, employee uptake of initiatives, EAP program usage, changes in reported health status and sense of well-being, and disability rates.
- Step 4: develop program content and measures. Formulate curriculum to meet the targets. Include long-term plans as well as solutions that achieve quick wins. Balance costs with benefits. Measures can be targeted to specific groups of employees (individual departments or shifts) or the whole organization. Examples include information and awareness campaigns about mental health (e.g. lunch-and-learn workshops), training employees to recognize and respond to co-worker distress, anti-bullying and discrimination actions, and formal workplace programs (e.g. smoking cessation program, employee weight-loss program).

- Step 5: implementation of the program. All organizational levels should be included in program communications. Programs designed to increase mental health awareness are sometimes met with skepticism, indifferent, or negative attitude that reflect stigma. Senior management must clearly communicate the significance of mental well-being at work, and reinforce the commitment the organization has made to creating a psychologically safe workplace. A written mental health policy will outline this commitment for all employees.
- Step 6: evaluate measures. Assess the effects of your initiatives. Compare baseline data with established targets. If there are differences between the results and the targets, determine where to apply changes that will lead to improvement.
- Step 7: incorporate a mental well-being program into organizational cultures. Practices that promote mental health at work should become part of the daily routine of your organization. This may include having regular meetings with employees to discuss stress and mental health problems, discussing workload and mental health in annual performance interviews, and encouraging management to take relevant training and show interest in the mental health of their employees.

9.11.6 Workplace Accommodations for Employees with Mental Illness

Workers with mental illness may require additional support or workplace accommodations, especially if they are returning to work after an absence. The following strategies can be used to facilitate employee return to work and provide ongoing support. It is important to evaluate the effectiveness of each accommodation and adjust as necessary.

- Workers: let the employer/supervisor know what would be helpful. Identify anticipated workplace challenges. Ask to be informed in advance of changes, if possible, to prepare psychologically. Ask to maintain communication with a previous supervisor to ensure effective transition. Ask for regular meetings to discuss work-related issues with supervisor.
- Supervisors: find out what is considered supportive to the worker and what may inadvertently make their symptoms worse.
- Flexible scheduling: allow reasonable time off to attend counseling sessions or medical appointments. Allow reasonable phone calls to doctors or others to gain necessary support during the workday. Consider part-time or split shifts, more frequent breaks, or graduated return to work.
- Changes in supervision: modify the way in which instructions and feedback are given (i.e. written instructions may help an employee to focus on tasks). Have brief weekly meetings between the supervisor and worker to help to deal with issues before they become serious.
- Changes in training: allow extra time to learn tasks. Allow the worker to attend training courses that are individualized.
- Exchanging tasks with other employees: maintain the balance of work while capitalizing on the strengths of each worker.
- Maintaining stamina and concentration: vary tasks throughout the day. Provide more opportunities to learn new responsibilities. Allow a self-paced workload. Remove all but essential functions of the job. Break large tasks into a series

of smaller tasks. Take a break when concentration declines. Increase natural lighting in your work area.

- Organization/deadlines: use an electronic organizer. Ask for regular reminders from the supervisor. Arrange regular meetings for follow-up and to set priorities.
- Working relationships: outline clear expectations. Ask for open and honest feedback in a prompt manner. Ask for correspondence in writing. Ask for written work agreements. Allow the option of not attending work related social functions.
- Handling stress and emotions: seek help from counselors or EAP. Ask employer to provide praise and positive reinforcement. Provide awareness training for employees on mental illness.

9.11.7 Discussing Mental Health Issues

Talking about mental health issues can be difficult. There is no single correct way to begin the conversation. Some suggestions include:

- *"How are you doing at the moment?"*
- *"I noticed…"*
- *"How can we help?"*
- *"Are there any work-related issues contributing to…?"*
- *"What solutions do you feel might help?"*
- *"Can we follow up by…?"*

Good communication is more than just talking. It involves active listening, being genuine, and having empathy and compassion. Tone of voice and body language are part of the message. Ask questions in an open and non-judgmental way. Resist making any judgments or conclusions about what is going on. Instead, invite the worker to talk about what they are experiencing, then repeat/paraphrase and ask if correct. Resist giving advice about what to do. Instead, continue to listen and ask what can be done to help.

The conversation should focus on the job performance, not the individual or the mental illness. The intention is to provide support and return the worker to the previous high level of performance. Three important areas to address include:

- What is needed to help the worker be successful at the job?
- How should future issues be addressed?
- For the workers contribution towards being successful: what will the worker commit to? What will the organization commit to?

Remember to respect the privacy of the worker. Mental health issues are medical problems and are generally considered confidential matters. During the conversation, limit questions about treatment or history of the illness to issues that are relevant to the work situation. Discuss exactly what the individual's wishes are with regard to telling or not telling co-workers, and determine who will say what.

Be honest and fair with the rest of the team. Do not breach any confidentiality agreements, either formal workplace agreements or those made privately between the supervisor and the employee. Create an environment where all members of the team can discuss concerns openly, and try to avoid gossiping or resentment toward the individual.

Be ready to:

- Have workplace policy about confidentiality and accommodation available.
- Provide access to an EAP or referral to community services.
- Discuss any functional limitations that could affect the person's ability to carry out duties.
- Discuss what steps or accommodations would enable the worker to continue to do the job effectively.
- Set a date to meet again to review the strategy and performance.
- Document the meeting and any agreements made.

During the conversation, these things should be avoided:

- Don't give a pep talk.
- Don't offer advice. Ask what can be done do to help.
- Don't be accusatory.
- Don't say, "*I've been there…*" (unless true).
- Don't try to diagnose or give a name to the underlying issue.
- Don't ask, "*What caused the illness?"* Focus on solutions.

A worker with a mental illness may not know or acknowledge that there is a mental health issue. In this case, there may be little that can be done to help. Focusing on work performance is the best approach. Also, the worker may not disclose the issue to a supervisor, but may seek help from EAP or other professionals.

9.12 Ground Disturbance

9.12.1 Introduction

The purpose of this standard operating procedure is to outline the necessary requirements to protect worker safety and to avoid contact with pipelines and underground facilities during ground disturbance activities. Refer also to the NEB-required Pieridae Damage Prevention Program and Public Awareness Program (DPP).

Examples of ground disturbances include:

- Pipeline installation;
- Pipeline repair;
- Pipeline tie-ins;

- Pipeline crossings; and
- Excavations (i.e. contamination removal/remediation).

This procedure will cover:

- Definitions;
- Responsibilities;
- Training;
- Search and notification;
- Surface land agreements;
- Identification and location of underground facilities;
- Hand exposure;
- Excavation;
- On-site procedures;
- Reporting hits;
- Third party work;
- Pieridae work; and
- Additional precautions.

9.12.2 Definitions

Ground Disturbance

- A ground disturbance is defined by the AER Pipeline Act as any work, operation or activity that results in a disturbance of the earth, including, without limitation, excavating, digging, trenching, plowing, drilling, tunneling, auguring, backfilling, blasting, topsoil stripping, land leveling, peat removing, quarrying, clearing and grading, but does not include a disturbance of the earth to a depth of less than 30cm (1 ft) that does not result in a reduction of the earth cover over the pipeline to a depth that is less than the cover provided when the pipeline was installed or cultivation to a depth of less than 45cm (1.5 ft) below the surface of the ground.

Excavation

- Any dug out area of ground other than a trench, tunnel, underground shaft or open pit mine.

Trench

- An elongated dug out area of ground whose depth exceeds its width at the bottom of the trench.

Hand Exposure Zone

- The distance from the locate marks within which mechanical excavation equipment shall not be used until the buried facility has been hand exposed.

Work Area

- The physical area where the ground disturbance is taking place.

Controlled Area

- The strip of land 30m wide on each side of a pipeline or the distance from the pipeline to the edge of the ROW, whichever is greater.

Search Area

- The additional area (30m in every direction) outside the work area that must be searched for underground facilities prior to a ground disturbance taking place.

Note: The controlled area and search area are very similar. The search area is the area that the party undertaking the ground disturbance must check. The controlled area is used when there is a known pipeline. Whether the search or controlled area, use the distance of 30m.

Crossing Agreement

- An agreement that authorizes one company to cross another company's property (i.e. pipeline, road, etc.).

Underground Facility

- Includes facilities such as pipelines, telecommunication lines, electrical lines etc. that are buried in the ground.

9.12.3 Responsibilities

Where a ground disturbance is to be performed the responsibility for safety prior to, during, and while backfilling, is the work site supervisor. The work site supervisor must ensure that applicable information has been obtained and is available on-site when required.

Pieridae will have two primary areas of responsibility; protecting its own assets (underground facilities) and conducting projects in areas where third party underground facilities may be located. These procedures detail the required response for either case.

Pieridae requires that a representative be on-site during third party work in two specific cases:

1) When there is more than one pipeline contained in the same ditch and either Pieridae or a third party is tying-in to a pipeline within the ditch; and
2) When the third party is tying-in to an Pieridae pipeline.

Pieridae on-site representatives have full authority to delay any work in Pieridae's ROW if there is any uncertainty with respect to pipeline identification.

9.12.4 Training

Those individuals that supervise ground disturbance activities must have ground disturbance training. Refer to Section 4.6.5 Ground Disturbance.

9.12.5 Search and Notification

Prior to conducting ground disturbance, all underground facilities within the work area as well as the search area (30m) must be identified.

Contact the applicable provincial One Call system to request the location of any underground facilities.

- In Alberta, call Alberta One Call Corporation at 1-800-242-3447 or complete an online request at www.albertaonecall.com. In Alberta, it is a regulatory requirement for pipeline licensees to register with One Call and subsequently register every pipeline regardless of operations status (newly constructed pipelines must be registered before being put into operation).
- In BC, call BC One Call at 1-800-474-6886 or complete an online request at www.bconecall.bc.ca. In BC, it is a regulatory requirement for pipelines to be registered with One Call.
- Not all underground facilities are registered on the One Call system. Additional sources of information should be consulted to confirm all underground facilities have been identified:
  - Check regulatory agency records for the existence of pipelines.
  - Check with local utility providers.
  - Check the land title for easements or ROWs.
  - Look for pipeline warning signs near the site. Signs are typically found at road or water crossings.
  - Look for wells, tanks, valve stations, and meter stations, which might indicate the presence of pipelines.
  - Look for ground settling from previous work.
  - Talk to nearby residents, landowners and operators.
- If it is established that underground facilities exist within the search areas, the owners of the underground facilities must be notified of the proposed activities.
  - Notification may be conducted by the One Call service, however any owners of underground facilities that are not registered with local One Call must be contacted directly.
  - Notifications must be made in accordance with jurisdictional requirements or standards to allow the owners time to conduct locating and marking.

Alberta	5 full working days
BC	
Quebec	
Nova Scotia	
Federal	3 full working days

  - Verification of the notifications must be available at the work site.

9.12.6 Surface Land Agreements

Where a ground disturbance involves a third party operating within the controlled area of an Pieridae underground facility, or where Pieridae is operating within the controlled area of a third party underground facility a written agreement must be in place prior to construction

Surface Land agreements are generally prepared by the Surface Land Department and/or representatives in consultation with engineering and the field staff.

Agreement Type	Description
Facility Crossing	Used when one company's facility physically crosses another company's pipeline.
Proximity	Any ground disturbance within 30m of proximity of another company's ROW.
Encroachment	Required when one company (company "A") encroaches on Company "B's" ROW to complete work but does not cross company "B's" underground facility.
Parallel	Used when one company parallels another company's ROW.
100 Metre Consent	Used when a company is drilling a well within a 100m of another company's underground facility.

Agreements shall specify the responsibilities of the parties and any conditions or limitations applicable of the ground disturbance such as:

- Angle and direction for placement of facilities with the ground disturbance area in relation to any existing facilities;
- Proper supporting of exposed facilities;
- Horizontal and vertical separation to be maintained between buried facilities;
- Notification time frames for locates, if different from regulations;
- Hand expose zone requirements;
- Limits of approach distances for mechanical excavation equipment, if different from regulations;
- Backfill material requirements and cathodic test leads;

Notification time frame required for an inspection before backfilling

Where there is a conflict between these standard operating procedures and an agreement, the agreement will generally take precedence (or the more stringent of the two).

9.12.7 Identification and Location of Underground Facilities

- Pieridae personnel must ensure all underground facilities are properly

identified, located, and marked with flags to show facility orientation prior to undertaking a ground disturbance. This includes the work area as well as the search area.

- The position and alignment of existing pipelines are marked with clearly distinguishable warning signs at adequate intervals before ground disturbance takes place in a controlled area (a controlled area extends 30m on each side of a pipeline).
- Mechanical excavation can be used to within 5m of an existing pipeline (or other underground facility).
- At distances of less than 5m, hand exposure must be used to expose the pipeline (or other underground facility).
- After the pipeline has been hand exposed (or exposed via hydrovac),
    - In Alberta, no mechanical excavation shall be used closer than 1m to the facility (or according to the Crossing Agreement, whichever is more stringent).
    - In BC, no mechanical excavation shall be used closer than 600mm to the facility (or according to the Crossing Agreement, whichever is more stringent).
- Ground disturbance activity must be started within 14 calendar days of the locate. The identification of underground facilities is valid for the duration of a project, provided the physical markings remain visible and are not disturbed.
- The following are the universal color codes for marking utility lines:

Colour codes for marking underground utility lines (universal standards)	
Electrical power lines, cables, conduits and ducts, or lighting wires and cables	Red
Gas, oil, petroleum, steam, or gaseous material	Yellow
Telephone, communications, cable TV, alarm or signal lines, wires, cable, conduits, or ducts	Orange
Water lines or pipes	Blue
Sanitary sewer, storm sewer, culvert, or drain lines	Green
Temporary survey markings	Pink
Limits of proposed excavation	White
Irrigation, reclaimed water, or slurry lines or pipes	Purple

- As excerpted from WorkSafeBC Prevention of Damage to Buried Facilities in BC

9.12.8 Hand Exposure

- When undertaking a ground disturbance that will cross or be carried out within

the hand expose zone of the locate marks, the underground facilities must be exposed by hand before commencing mechanical excavation.

  - The hand expose zone is 5 m for provincially regulated pipelines and 3 m for federally regulated pipelines (or according to the Crossing Agreement, whichever is more stringent). The hand expose zone for other types of underground facilities is typically 1 m.

- When exposing a regulated pipeline, the licensee shall be present at the time the pipeline is being exposed, unless otherwise agreed.
- There are no maximum limits on the extent of hand exposure required. Underground facilities shall be exposed as needed to confirm their identification, number and alignment.
- Hand exposure requirements should be extended to the proposed depth of the ground disturbance.
- If a proposed ground disturbance will be parallel to and within the hand expose zone of a pipeline, the pipeline may be exposed at intervals along the pipeline in accordance with the Crossing Agreement.
- When exposing a facility by hand digging:
  - Never probe for the facility with pointed tools such as pick axes or pointed bars.
  - If possible, blunt shovels should be used to expose the facility. If spade-shaped shovels are used, caution should be taken, especially with newer, sharper spade shovels.
  - Diggers should never jump on or use their entire body weight on the shovel.
  - Use a prying (rather than striking) motion to loosen hard dirt.
  - Dig on an angle if possible, such that any contact with the facility is a glancing blow as opposed to a direct hit.
- When exposing a facility by hydrovaccing adhere to specific conditions specified by the facility owner such as maximum pressure, maximum temperature or type of nozzle to protect the integrity of the underground facility.
- Exposed facilities must be properly supported and protected. Unsupported exposed facilities may sag and cause breaks or damage.

9.12.9 Excavation

- After a pipeline has been hand exposed (or exposed via hydrovac), no mechanical excavation shall be used within 60 cm of the pipeline or within any distance beneath the pipeline or as specified in the Crossing Agreement (whichever is greater), except under the direct supervision of and with permission from the pipeline owner.
- A spotter should be used whenever mechanical equipment is working near an underground facility.
- When soil conditions permit, a smooth edge bucket should be used when excavating near underground facilities.
- Temporary fencing should be erected along the right of way to limit access of

equipment that may cause damage to the pipeline.

- Proper crossing should be constructed to allow access over the right of way if needed.
- Excavations must be flagged, marked, or safeguarded to prevent workers or equipment from falling into the excavation when there is a hazard.
- An excavation must be kept free of an accumulation of water that may pose a hazard to the worker or the stability of the excavation.
- Safe entry and exit of the excavation must be provided if necessary.
- Personnel working in trenches (AB - narrower than depth and over 1.5 m deep; and in BC – before entering any excavation of 1.2m/4ft in depth or, while in the excavation, approaches closer to the side or bank than a distance equal to the depth of the excavation) must be appropriately protected from cave-in (i.e. sloped; sloped at angles; benched; supported; supported by manufactured or prefabricated trench boxes).
- Excavation and trench walls must be properly sloped, shored or otherwise supported as per local OHS regulations.
- The sides of an excavation must be scaled and trimmed to prevent slides of material that could endanger workers.
- Edges of the excavation must be kept free of loose soil, debris, soil piles and material stockpiles.

9.12.10 On-site Procedures

Supervision

- No Pieridae owned facilities shall be exposed without the presence of an Pieridae work site supervisor.

Permits

- For hot work or for worked as deemed appropriate by the work site supervisor, a safe work permit is required. Refer to Appendix 1, Form 18 – Safe Work Permit.
- A ground disturbance permit is an additional requirement for any intentional excavation that disturbs the earth to a depth of 30cm or greater, or if there is a reduction in the amount of earth cover over a pipeline from that when it was installed (regardless of depth). Refer to Appendix 1, Form 08 - Ground Disturbance Permit.
- When uncertainty exists regarding the depth of the facility (i.e. the facility may be located within the initial 30 cm i.e. muskeg or “old” facilities without as-builts), a ground disturbance permit must be completed.

Pre-Job Safety Meeting

- Prior to the ground disturbance taking place, a pre-job safety meeting must be conducted in accordance with Pieridae standard operating procedures and must cover all safety and procedural aspects of the ground disturbance activity to be completed.
- The pre-job safety meeting together with the use of the safe work permit and

the ground disturbance checklist will facilitate discussion of all potential hazards and controls, including evaluating the risk of excavating near live pipelines and suitable controls.

- If possible, all parties involved in the ground disturbance should be present.

Backfill Inspection Report Form

- Upon completion of the ground disturbance, if any non-Pieridae facilities have been hand exposed for the purpose of identification (any facilities within 5m of the ground disturbance and/or within the hand expose zone), a Backfill Inspection Report form must be completed by the work site supervisor and signed by both affected parties. Refer to Appendix 1, Form 01 – Backfill Inspection Report. A minimum of 24-hour notice is generally required prior to backfilling a third party line.

Record Retention

- The ground disturbance permit and backfill inspection report will be kept on file for a minimum of two years.

9.12.11 Reporting Pipeline Hits and DPP Incidents

Refer to provincial requirements. Refer also to the NEB-required Pieridae Damage Prevention and Public Awareness Program (DPP).

If there is a “hit” (i.e. puncture, rupture, flattening, denting or any damage to the underground facility) an incident report must be completed.

- In Alberta, hits must be reported to the AER. As per the Pipeline Act the licensee of the pipeline shall immediately notify the AER of the location of where the contact occurred and the damage that resulted from the contact.
- Hits on a third party line must be reported to the third party.
- Incidents must be reported as per Pieridae procedures and as required by regulatory authorities.
- If there is a spill or release resulting from the “hit” then a spill/release report must be completed.

9.12.12 Third Party Work

This section will briefly describe the general surface land process and field responsibilities when a third party is working within or near an Pieridae ROW.

- The Surface Land Department will receive a written request for written approval to work within or near an Pieridae ROW (i.e. crossing, proximity, parallel etc.).
- The Surface Land Department will prepare and execute the appropriate agreement including any specific conditions.
- The Surface Land Department will notify field staff and obtain input as required.
- The third party will return an executed copy of the agreement for the Surface Land file.
- The third party must have the agreement on-site during the ground disturbance

activities / field activity.

- Pieridae agreements stipulate that the third party must notify field staff prior to field activity.
- Field staff must ensure Pieridae facilities are accurately located and marked.
- If multiple pipelines are located within a ROW or search area, additional precautions may be required to properly identify Pieridae's facilities.
- If an Pieridae facility is exposed it is standard industry practice to receive 24 hours notice from the third party prior to backfilling so that the facility can be inspected for damage.
- The third party will prepare a backfill inspection report. Pieridae should request a copy of the report and copy should be retained on the field file and a fax copy sent to the Surface Land Department for file.

9.12.13 Pieridae Work

This section will briefly describe the general surface land process and field responsibilities when Pieridae is undertaking work within or near other third party facilities or ROWs.

- Once routing has been established a search will be completed by the Surface Land Department to identify all facilities within the search area.
- If third party facilities are identified a request will be made by Surface Land Department to the third party for written approval (i.e. crossing, proximity or parallel etc.).
- Once received, agreements will be executed and filed in the Surface Land file.
- As required (it may be a condition of the agreement) copies of Surface Land agreements will be sent to the work site supervisor. These agreements must be on-site and provide useful and required contact information and any special conditions that the third party may require.
- It is the responsibility of the work site supervisor to inspect the facility crossing area and to ensure the crossing is properly marked (i.e. surveyed / line located).
    - Obtain a sketch from the line locator.
    - Complete visual field checks including survey markers and signs of prior disturbance, surveys, operator knowledge, as-builts etc.
    - Be aware of the potential for more than one pipeline in a ROW or trench.
- If multiple pipelines are located within a ROW or search area, additional precautions may be required to properly identify pipelines.
- The work site supervisor will notify the third party field representative as designated in the agreement.
- The work site supervisor will complete a safe work permit as deemed appropriate; complete the ground disturbance permit and conduct a pre-job safety meeting.
    - Ensure the contractor is aware that mechanical excavation is not to occur within 60cm of the underground facility after the facility has been hand

exposed (or exposed via hydrovac).

- The work site supervisor will supervise the ground disturbance activities including:
  - Inspect ramps and fencing;
  - Supervise hand exposure and inspect pipe;
  - Ensure digging limitations are not violated; and
  - Ensure personnel working in excavations or trenches (narrower than depth and over 1.5m deep) are protected from cave-in.
- The work site supervisor will prepare and conduct backfill:
  - Notify third party that backfilling will occur (typically give 24 hours notice).
  - Inspect all piping prior to backfilling.
  - Ensure proper backfill methods and equipment are utilized.
  - Complete a backfill inspection report. Provide a copy to the third party field representative if requested.
  - Retain copies of all associated documentation.
  - If there is a “hit” (i.e. puncture, rupture, or any damage to pipelines) it must be reported to the appropriate regulatory agency (e.g. AER).

9.12.14 Additional Precautions for Multiple Pipelines

It is important that both the ground disturber and the owner of any underground facility understand the importance of adequately identifying multiple underground facilities. In the case of multiple pipelines in a right-of-way (ROW) or ditch, especially if the pipelines are the same outside diameter (OD), it will be important to take additional precautionary measures to properly identify the ownership of each pipeline. This is especially important if any of the pipelines will be physically worked on (i.e. tie-in or repair). The potential for property damage, spills and even injury or loss of life is significant if an error is made in pipeline identification.

Area operations personnel must understand that if they are uncertain regarding the identification of the buried facilities that they have the right to delay work and or refuse to permit work to continue until the correct facilities can be adequately identified. CSA Z662 stipulates that property owners must have adequate knowledge of their facilities.

In the event of a ground disturbance in an area of multiple pipelines, where the pipelines are the same outside diameter, the following additional precautions should be utilized to properly identify pipelines contained within the ditch when work will be completed on one of the pipelines by either Pieridae or a third party. These additional precautions are applicable once proper ground disturbance procedures have been followed and the pipelines are properly exposed.

Before work proceeds, the following questions should be asked:

- Is work going to be completed (i.e. tie-in) on any of the pipelines in the open excavation (i.e. work other than a pipeline crossing or line location in a work area)?
- Are the pipelines contained in the ditch various outside diameters?
- Which is the target pipeline(s)? Can this be positively confirmed?
- Which is the Pieridae pipeline(s)? Can this be positively confirmed?

A phased process is to be utilized to adequately identify the pipelines:

- If the pipe specifications of the pipeline are known they may be stenciled clearly on the pipe.
- If the pipe specifications are unknown and/or are not stenciled clearly on the pipe then a phased approach should be taken to properly identify the pipelines:
    1) Contact line locators to positively identify the pipeline. The line locators will tie onto a known location (i.e. riser) and will send a signal down the pipeline to the open excavation. They will then tie on to the pipelines in the excavation to identify the target pipeline.
    2) Utilize acoustics to positively identify the pipeline.
    3) Depending on who is doing the work (Pieridae or a third party) the actual tie-in method will be dependent on the situation and should be reviewed by engineering on a project specific basis.
    4) After utilizing the above steps to identify the pipeline, if any uncertainty remains about the correct identification of the pipeline that will be worked on, further methods are to be utilized to further reduce hazards to the on-site workers including:
        - Depressurize applicable pipelines contained within the ditch.
        - Utilize a hot tap method.

However, please note that if the wrong pipeline has been identified and both pipelines have been depressurized and/or remain pressurized that these two methods of further reducing hazards to on-site workers will not ensure that the correct line has been tied-in to. Therefore, it is recommended that the target tie-in pipeline be depressurized and if there is no pressure or temperature during the hot tap it is likely that the correct pipeline has been tied-in to.

It is imperative the on-site workers know and understand their right to refuse to do unsafe work under the Occupational Health and Safety Act. If it is a third party job and Pieridae is uncertain of the identity of its pipeline then no work should proceed until additional precautionary measures are taken.

9.13 Hand Tools

9.13.1 Safe Work Guidelines

The following are some basic tips for using hand tools.

- Select the right tool for the job.
- Check tools before each use to ensure they have not been damaged.
- Use only tools that are in good repair.
- Inspect tools for defects before use. Replace or repair defective tools.

Refer to manufacturer's specifications for use of specific tools. The use of certain tools will necessitate the use of additional personal protective equipment appropriate to the task. Examples of the safe manner to use hand tools include:

- When using a sharp-edged tool, push it away from the body.
- When using a screwdriver, secure the object in a vice, if possible.
- Grasp pliers near the end of the handles, not close to the hinge.
- When using wire cutters, take care that the wire ends do not cause injury. Wear eye and/or face protection and point the cutter away from face.
- Use spark-resistant tools when working near flammable materials.
- Do not throw tools to another worker or onto a work surface.
- Do not carry tools in hands when going up or coming down a ladder (use a tool belt).
- Clean and return tools to their proper place when not in use.
- Store sharp-edged tools separately from the other tools.
- Do not carry tools in pockets, especially if sharp or pointed. Use a tool kit or tool belt.
- When working overhead, make sure that tools cannot fall to lower levels. Do not leave tools on overhead ledges, beams, window sills, etc.
- Tools must be inspected before each use, and taken out of service if defective. If the tool can be repaired it should be tagged "do not use" or if it cannot be repaired it should be disposed. Routine maintenance, including frequent cleaning and sharpening is a necessity.
- All portable and stationary grinding tools must be equipped with an appropriate guard and/or tool rest. Face and eye protection must be worn while using grinders.

9.13.2 Production Operator Required Equipment and Hand Tools

The following list of equipment and hand tools is required in production operator vehicles in Alberta and BC. The list may change depending on the operating production area. Confirm with the supervisor. Refer to Form 23 – Vehicle Inspection Checklist.

- Ditch Hitch Tow kit
- Booster cables 20'
- #1 First Aid Kit
- Emergency flares (triangle reflectors 3 in a kit)
- LED Flashlight

- Ratchet Straps (x2)
- Cell Phone Booster System
- 30lb Fire Extinguisher C/W Bracket
- Pipe wrench 18" Aluminum
- Pipe wrench 24" Aluminum
- Crescent Wrench 12"
- Crescent Wrench 15"
- Vice Grips 10"
- Pliers Water Pump 12"
- Needle Nose Pliers 8"
- Side Cutter Pliers 7"
- 14 piece Combination Wrench Set (3/8" to 1")
- Hammer (Brass 5lb)
- Hammer (Ball-peen 2lb)
- Wire Brush
- Pry Bar 16"
- Allen Key Set (SAE)
- Assorted 1/2" Drive Socket Set (3/8" to 1")
- Assorted 3/8" Drive Socket Set (1/4" to 7/8")
- Screwdriver Set 10 Piece
- Long Handle Round Spade
- Axe
- Garden Rake
- Baker Pump
- Wajax
- Cargo Net
- Packing Puller
- Two Way Radio for Vehicle

9.14 Hot Work

9.14.1 Introduction

Hot work involves any work that creates a potential source of ignition (i.e. flame or spark).

Hot work is work in which a flame is used or sparks or other sources of ignition may be produced, including: cutting, welding, burning, air gouging, riveting, drilling,

grinding or chipping. Hot work also includes activities such as the use of portable heaters, use of steam cleaning equipment, use of non-classified electrical equipment in a hazardous location, and the introduction to a work process a combustion engine. Fire and explosion can occur due to improper or inadequate preparation for hot work.

This procedure will cover:

- Responsibilities;
- Isolation;
- Atmospheric testing;
- Safe work areas;
- General considerations; and
- Hot Tapping.

9.14.2 Responsibilities

A safe work permit must be completed for hot work. The work site supervisor will assess work areas and determine whether or not it is safe to perform hot work. Depending on the situation it may be necessary to assign a watchman (i.e. stand-by person) to ensure that conditions are continually monitored.

9.14.3 Isolation

All equipment on which hot work is to be performed must be positively isolated from all sources of flammable, combustible, or toxic materials. Refer to Section 9.17 Isolation (Lock Out Tag Out).

9.14.4 Atmospheric Testing

No hot work may be performed where a flammable or combustible solid, liquid, or gas is present unless proper atmospheric testing has been conducted to determine whether the atmosphere contains a flammable substance in a quantity sufficient to create an explosive atmosphere. The atmosphere must not exceed 20% of the substances LEL if hot work will be performed. Tests must be done to ensure that the work may be safely performed. Refer to Section 9.3 Atmospheric Testing.

9.14.5 Safe Work Areas

The area within a certain radius of where hot work is taking place must be identified as the safe area. In this area flammable materials cannot be exposed to any ignition sources. In high wind conditions, the ignition hazard may be carried farther than normal and consideration should be given to the wind direction and force. The travel of sparks may be limited by using spark and fire retardant canvas.

If at any time during the job, an emergency alarm sounds, stop all work immediately and evacuate the area to an identified muster location.

9.14.6 General Considerations

- Open drains within a 15m radius of where the hot work will be completed must be covered and sealed.
- Ensure equipment is properly bonded and grounded and only insulated connectors are used when joining lengths of cable.
- Ensure signs and barricades are place in the hot work area to warn other workers of the hazards.
- Use exhaust ventilation to remove welding fumes.
- In hot work areas, oily surfaces and oil spills must be hosed down and sanded over (minimum depth of 2.5cm).
- Oil soaked ground must be excavated and removed from the area.
- All trash and oily rags must be removed from the area.
- Flammable solvents must not be used or be present in the area where hot work is taking place.
- Particular attention is required for danger of expansion of oil or gas in the equipment (lines, vessels) immediately adjacent the hot work area.
- Any hot work equipment will be used in accordance with the manufacturer's intended purpose and guidelines for use.

9.14.7 Hot Tapping

A hot tap is a process of penetrating through a pressure-containing barrier of a pipeline, line, piping system, tank, vessel, pump casing, compressor casing or similar facility that has not been totally isolated, depressurized, purged and cleaned. In theory, because oxygen (air) is not found within the line, the probability of a fire or explosion is remote. The advantage to hot tapping is that it can occur without disrupting the process.

Hot tapping operations can be considered when continuity of service is essential or shutdown of the system is impractical.

Before proceeding to hot tap, the following conditions must be satisfied:

- Site specific procedures including engineering connection designs and safety instructions and training requirements should be established before the commencement of a hot tap. Specific hot tap procedures must be written and available on site.
- The connection area is clearly marked.
- Safe work permits have been issued, potential hazards have been reviewed at the pre-job safety meeting and appropriate controls are in place.

Qualifications

- Welders working on piping must be certified ASME B31.3.
- Welders working on pressure vessels must be certified as per ASME Boiler and Pressure Vessel Code.
- Structural welders must be qualified journeymen.
- Pressure Vessel and Process Piping contractors must have a quality control program registered with the Boiler's Branch Safety Association (AB) or the Boiler and Pressure Vessel Branch (SK).
- CSA Z662 standards must be followed to ensure maintenance of pipeline quality.

9.15 Housekeeping

9.15.1 Introduction

Good housekeeping is an important component of prevention of work site hazards such as slips, trips, falls, fire hazards and environmental conditions such as spills or leaks. Good housekeeping is a daily responsibility of all workers and is a continual process. Each work site must be kept clean and free from slipping and tripping hazards and waste materials should not accumulate around equipment endangering workers or restricting safe access to or egress from equipment.

9.15.2 General Considerations

- All spills or leaks must be reported to the work site supervisor and must be cleaned up immediately thereafter. If this is impractical, signs and barricades must be posted until the hazard can be removed.
- Material which is to be stacked shall be cross-tied or otherwise secured so it will not fall over.
- Aisles and walking surfaces shall be kept clear of materials and equipment as much as is practical.
- At the end of each shift, ensure that tools are cleaned and properly stored, scrap and waste materials are disposed of, and the equipment and work location is in clean and orderly condition.
- Only approved solvents must be used for cleaning purposes. Gasoline must not be used as a cleaning agent.
- Garbage is to be collected in barrels and disposed of on a regular basis at an approved landfill site.
- Oilfield waste is to be stored in approved containers and disposed of as required at an approved disposal facility.
- Oily rags, filters, etc. are to be collected separately from other wastes in approved metal containers and disposed of in compliance with current regulatory requirements.
- Fire extinguishers must be stored in their specified location except during routine maintenance or in case of fire.
- Floors and walkways are to be kept clean and free of debris.

- Work areas must be kept free of hazardous accumulations of combustible substances (combustible dust). Use cleaning methods that prevent as much as reasonably practicable the generation of airborne combustible substances.

9.16 Hydrogen Sulphide (H_2S)

9.16.1 Introduction

Hydrogen Sulphide (H_2S) can be present at oil and gas wells and production facilities. H_2S is poisonous and combustible. H_2S content can be expressed as a total percentage in the air. The difference between parts per million (ppm) and percent (%) is significant.

- The human nose can detect H_2S at 0.01-0.3ppm.
- 1ppm H_2S is a low concentration.
- 10ppm H_2S is the occupational exposure limit for an 8-hour work day.
- 15ppm H_2S is the ceiling occupational exposure limit. No one should be exposed to 15ppm without proper respiratory equipment.
- 100-200ppm H_2S will cause severe nose, throat and lung irritation; ability to smell odor completely disappears.
- 1,000ppm (0.1%) will result in immediate loss of consciousness, permanent brain damage and death if not rescued immediately.
- The LEL of H_2S is ~40,000ppm (4%).
- Emergency planning zones (EPZs) are calculated for sour gas wells and associated facilities where there is a concentration greater than 0.1 moles per kilomole (mol/kmol) which is 0.0001 mol fraction or 100ppm or greater. If there is a residence within an EPZ then a site specific ERP is required.

H_2S can react with rust or corrosion deposits on equipment to form iron sulphide. This reaction occurs in an oxygen free atmosphere where H_2S gas is present or where the concentration of H_2S is greater than that of oxygen. This happens most often in closed vessels, tanks or pipelines. Iron sulphide is a pyrophoric material, which means it can ignite spontaneously when it is exposed to air. Refer to 9.3.5 Iron Sulphide Fires.

A code of practice is required by Alberta OHS for work sites where there may be more than 10kg of H_2S present as a pure substance, or in a mixture in a concentration over 0.1% by weight and at least 10kg of H_2S in aggregate. This procedure provides the basis for the code of practice, together with Section 4.0 Training, Section 5.0 Personal Protective Equipment and Section 11.0 ERP. Site specific procedures should also be developed to augment these procedures at sour facilities/operations.

If there is a potential for a release of H_2S into the atmosphere at levels of 10ppm or greater then operations at the site should be treated as "sour" for the protection of human health.

This procedure will provide an overview of the following:

- Worker responsibilities and training requirements;
- H_2S characteristics;
- H_2S exposure limits;
- Operating procedures;
- H_2S testing procedures;
- Working in H_2S conditions; and
- Initial emergency response procedures.

9.16.2 Responsibilities and Training Requirements

All employees that may be exposed to H_2S must maintain H_2S certification. For each work site where H_2S is a potential hazard, the worker and the work site supervisor have an obligation to be aware of and to communicate the hazards.

Work Site Supervisor

- Ensure that each worker (employee or contractor) is aware of and follows H_2S procedures.
  - Follow safe work permitting procedures.
  - Communicate emergency procedures to all workers.
- Maintain H_2S certification.

Worker

- Follow procedures.
- Maintain H_2S certification.

9.16.3 H_2S Characteristics

H_2S is a naturally occurring gas found in a variety of geological formations. It is also formed by the natural decomposition of organic material in the absence of oxygen. H_2S gas is colorless, heavier than air (it can accumulate in depressions, ditches, tanks etc.) and is extremely toxic.

In small concentrations, it has a rotten egg smell and causes eye and throat irritation. H_2S can deaden the sense of smell and, at higher concentrations, causes death.

H_2S Characteristics

Physical State	Normally encountered as a gas.
Color	Colorless (no visible sign of H_2S to warn of its presence).
Odor	Smells like "rotten eggs" at low concentrations (H_2S impairs the sense of smell at low concentrations; do not rely on your sense of smell to detect H_2S).
Vapor Density	Slightly heavier than air (1.19 versus 1.0 for air).
Solubility	Dissolves in water, oil, sludge, emulsions, well fluids and molten sulphur (H_2S is released when liquids are agitated, depressured or heated).
Flammability	Flammable (burns with a blue flame and gives of sulphur dioxide gas (SO_2)).

9.16.4 H_2S Exposure Limits

Alberta Occupation Exposure Limits (OEL) for H_2S

	AB	BC	
8 hour OEL	10ppm	10ppm	A time-weighted average (TWA) maximum exposure for an 8-hour work day.
15 minute or ceiling OEL	15ppm	10ppm	No one should be exposed to greater than 15ppm of H_2S at any time without adequate respiratory equipment.

Short-term (acute) exposure to H_2S can cause irritation to the nose, throat, eyes and lungs. Exposure to higher concentrations can cause very serious health effects, and even death.

- Exposure to 500ppm (0.05%) of H_2S will result in severe lung irritation, excitement, headache, dizziness, staggering, sudden collapse (knockdown), unconsciousness and death within a few hours, loss of memory for the period of exposure.
- Exposure to 500-1000ppm (0.5% - 0.1%) of H_2S will result in respiratory paralysis, irregular heartbeat, collapse and death without rescue.
- Exposure to greater than 1000ppm (0.1%) of H_2S will result in rapid collapse and death.

9.16.5 H_2S Operating Procedures

In Alberta the AER regulates and monitors which oil and gas reservoirs are defined as sour gas reservoirs versus sweet gas reservoirs. In general, the presence of H_2S in a gas stream should be known and documented for a particular reservoir or well.

Prior to drilling operations, the expected presence of H_2S is identified and measures are taken to ensure workers are protected from H_2S gas and that equipment is designed to the correct engineering specifications. A specific ERP may be required.

Site specific procedures will be developed if working in a sour gas field (i.e. worker orientation, training, testing, sampling, worker tracking). In addition to site specific procedures, if working in a known sour gas field, the following basic precautions will be used at work sites:

- A wind direction indicator will be installed in a conspicuous location.
- Before entering a work site, all workers will wear a personal H_2S monitor, or a fixed or continuous H_2S detection system will be in place.
- Vehicles are to be parked up wind, in a safe location, relative to a potential or identified H_2S area or building, and should be parked facing off the lease (for ease of egress).

9.16.6 H_2S Testing Locations

When conducting monitoring for H_2S to comply with the OEL (10ppm) a direct-reading instrument can be used and it must be used, calibrated and maintained according to manufacturer's instructions. Refer to 5.11 Gas Detection Equipment.

- Low lying areas (at grade level);
- Low areas below grade level;
- Inside process and compressor buildings, in corners or areas where there is no air movement;
- Within dikes around a storage tank; and
- Around wellheads.

If testing indicates H_2S concentrations of 10ppm or more, and ventilation is not possible, follow the procedures outlined in 9.12.7 Working in H_2S Conditions.

9.16.7 Working in H_2S Conditions

H_2S concentrations should first be determined through testing. Once "typical" levels are known, site specific procedures will be developed.

Working in H_2S Concentrations Less Than 10ppm

- Be aware if there are fixed or continuous H_2S monitors and alarms in place. Understand the alarms. A personal safety monitor should be worn. Refer to Section 5.11 Gas Detection Equipment.
- If there is not a fixed or continuous H_2S monitor and alarm in place, a personal monitor must be worn (or a portable H_2S detector utilized). Follow the occupational exposure guidelines defined above (i.e. alarm at 10ppm).

Working in H_2S Concentrations Greater than 10ppm

- Workers must use a fully operational, personal H_2S gas monitor (or multi-head gas unit) whenever there is risk of potential exposure to H_2S.
- If H_2S concentrations in the work area exceed 10ppm, workers will immediately report to the work site supervisor and follow site specific procedures.
- If it is not practicable or feasible to use engineering or administrative controls to reduce the exposure to H_2S then personal protective equipment must be used. Respiratory protective equipment is used to protect workers from inhaling airborne contaminants. Refer to Section 5.10 Respiratory Protective Equipment. A full-face piece positive pressure supplied air respirator is needed for work areas where H_2S concentrations exceed the OEL (10ppm).
- Pieridae targets zero exposure to H_2S. All work must be planned to eliminate or minimize worker exposure to H_2S.
- All workers must exercise the obligation and right to refuse unsafe work. If a hazardous situation occurs, the hazard reporting procedure will be followed and a solution to eliminate the risk developed.
- When a task involves opening or breaking the integrity of any equipment, piping or meter run in a “sour” system, protective breathing apparatus must be used.
- When it cannot be avoided and work is required in an environment that is immediately dangerous to life and health (i.e. IDLH >100ppm H_2S) the worker must be attended by a backup worker stationed at or near the entrance to the work area. The backup worker must be: present at all times for the duration of the task; equipped with suitable breathing apparatus; capable of initiating a rescue as required; able to communicate with the worker under mask; and be able to call for assistance.
- No worker shall attempt to initiate a rescue in any potential H_2S environment without using proper breathing apparatus. Other hazards must be considered, including flammable or explosive atmospheres.
- Equipment is to be maintained in safe working order at all times. Monitors must be calibrated, serviced, and repaired as per manufacturer’s specifications. Any equipment found not to be functioning properly must be tagged and removed from service until repaired and recalibrated, or replaced, as required.
- Emergency procedures must be in place and understood by all workers.
- A pre-job meeting (hazard assessment via the use of a safe work permit or a pre-job safety meeting or similar tool) is required and must be attended by all workers involved and meeting minutes shall record: the scope of the task; H2S hazards and where H2S can potentially occur; discussion of potential hazards along with controls to mitigate the identified hazards; equipment to be used; safety watch and back up requirements; rescue procedures and muster area; alarms; respirator locations; and communication procedures.

Truck Loading/Unloading

- When hydrocarbon products containing H_2S are handled for transportation by trucks, equipment must be designed, and/or procedures must be in place to prevent exposure to hazardous vapors during loading or offloading. Refer to Section 9.30 Truck Loading/Unloading.

9.16.8 Initial Emergency Response Procedure

Refer to the Section 11.0 Corporate Emergency Response Plan. In general:

- **Evacuate** – immediately leave the area in an upwind direction.
- **Alarm** – call for help "man down". Notify the work site supervisor.
- **Assess** – do a head count and consider other hazards.
- **Protect** – put on breathing apparatus (before attempting a rescue).
- **Rescue** – if safe to proceed, remove victim to a safe area.
- **First Aid** – conduct first aid as necessary.
- **Medical aid** – Arrange transport of victim to medical aid and provide information to emergency medical services.

9.16.9 Reporting

Any situation where an unplanned release of H_2S affects workers at a work site must be reported to the work site supervisor immediately. Regulatory reporting of such releases varies. Any H_2S exposure resulting in personal injury must be reported as soon as possible. Refer to Section 12.3 Regulatory Reporting (OHS reporting requirements).

9.17 Isolation (Lock Out Tag Out)

9.17.1 Introduction

Isolation allows equipment to be taken out of service for servicing, repairing, testing, adjusting or inspecting machinery, equipment, powered mobile equipment, piping, pipelines, or process systems. If there is a hazard to workers, control of hazardous energy involves the following steps:

- Isolate the location at which work is being carried out from sources of energy. This is accomplished by shutting off the machine, equipment, or process systems, or regulating flow in piping or pipelines and by operating or installing a mechanical device (energy-isolating device) that relieves, blocks, bleeds, restrains, or otherwise prevents or controls the transmission or release of energy for each energy source that may affect the work area.
- Verify the work area is isolated from all energy sources and the machinery, equipment, piping or process system is inoperable. This requires that energy from each source cannot reach the work area. In the case of interlocked systems, the interlock sequence should be fully completed or overridden.
- Lock the isolation by ensuring the energy-isolating device and all relevant components are physically secured to prevent the release of energy that could cause inadvertent movement or activation. Access to the securing device must be properly managed.
- Once the work activity is completed, return to system to operation.

Work cannot be performed until the equipment has come to a complete stop and all sources of hazardous energy have been isolated by an energy-isolating device

and the device has been secured. A safe work permit should be issued prior to any work that involves isolation of equipment.

Isolation or “lock out” procedures are designed to prevent injury when equipment is unexpectedly energized, unexpectedly started up or releases stored energy. This stored energy can be electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other. Hazardous energy includes machinery, equipment and powered mobile equipment, as well as piping, pipelines and process systems containing a harmful substance under pressure. There are three approaches to securing an energy-isolating device: by individual workers; by a group, or by a complex group process. The alternative practice of “otherwise rendered the equipment inoperative”, may involve removing vital parts of the equipment, putting blocking in place, pinning or other equally effective methods. Whatever method is used, it must provide a level of worker protection equal or greater than provided by isolating and securing. If alternative procedures are used, workers must know that equipment modification is part of a lockout and that the modification must not be altered.

In some instances, it may be necessary to work on equipment while it is operating e.g. trouble-shooting, minor adjustments, testing, etc. This approach is only justifiable if it is required by the manufacturer or it is not reasonably practicable in the case where there are no manufacturer specifications, to render the equipment inoperative. The approach cannot be used because it is more convenient than isolating and securing. Written procedures for control of identified point of hazardous energy must be in place to ensure the work is performed safely. Refer to Section 6.1 Hazard Identification and Control.

When work involves piping, a pipeline, or a process system that contains a harmful substance the flow must be stopped or reduced to a safe rate of flow. The location at which the work is to take place must then be isolated from the flow and the isolation secured.

Every effort must be made to properly communicate, document and isolate equipment before any maintenance, set-up, commissioning or service work is performed. A safe work permit should be issued.

This section covers:

- Responsibilities (including steps for individual and group securing);
- Blinding, blanking and double block-and-bleed; and
- Lock out checklist.

9.17.2 Responsibilities

Prior to any equipment being isolated it is important that there is agreement by the work site supervisor, workers and contractors as to the specific equipment that will be taken out of service. This is achieved, in part, by completing a safe work permit. Work cannot be performed until the equipment has come to a complete stop, all sources of hazardous energy is isolated by an energy-isolating device and the device is secured either by individual workers, a group, or by a complex group process.

Before carrying out work, all energy-isolating devices that control an energy source and will be involved in isolation must be located. This may include isolation points in different areas. Examples of energy-isolating devices are: manually operated electrical circuit breakers; disconnect switches; line valves; and blocks or similar devices that blocks or isolates energy. Push buttons, selector switches and other control circuit type devices are not energy-isolating devices.

To ensure that there is no inadvertent release of energy or energization, the energy-isolating device(s) must be physically secured in the isolating position. A securing device is anything such as a personal lock that holds an energy-isolating device in its off or safe position. The device must be “positive” meaning that once secured into position, it cannot fall off or allow the energy-isolating device to move from its off or safe position.

9.17.2.1 Securing by Individual Workers

- Each worker must attach their own personal lockable securing device (typically a keyed padlock) to the energy isolating device.
- The worker who places a lock is also responsible for verifying that the energy source has been isolated.
- If there is more than one worker working at the isolation point, each worker must attach their own lock to the energy isolating device. The first worker to do so must then verify, on behalf of all workers, that the energy source has been effectively isolated.
- Personal locks must be traceable back to the worker who installed it (bear a marking unique to each worker or bear an identification tag).
- If a worker is reassigned or the work is extended from one shift to another, continuity of isolation must be maintained by: another worker placing their own lock prior to the first worker removing their lock; or ensuring an effective transfer of control of the initial worker’s lock to another worker.
- If the worker removes the lock it means that the equipment is ready to be returned to operation. The final lock that is removed is the most critical. A lock should not be removed until it is safe to do so.

9.17.2.2 Securing by a Group

- Used when multiple workers are involved or multiple energy-isolating devices must be secured (e.g. ten workers on a project requiring 4 energy-isolating devices).
- A written procedure is required.
- Typically, the work site supervisor is assigned the responsibility of placing and/or activating the energy-isolating devices. Another worker (or the same worker), must then place a lock on each energy-isolating device and put the key to each securing device in a lockable key-securing device (lock box, key ring etc.) and complete, sign and post a list identifying the machinery or equipment involved. Refer to Appendix 1, Form 13 – Lock Out. Verify that energy sources have been effectively isolated.
- Once effective isolation is verified and before starting work, each worker must then apply their own lock to the key-securing device (this ensures that the master key(s) cannot be removed from the key-securing device).
- If a worker is reassigned or the work is extended from one shift to another, continuity of isolation must be maintained by: another worker placing their own lock prior to the first worker removing their lock; or ensuring an effective transfer of control of the initial worker's lock to another worker.
- Upon completing the work, each worker removes their own lock from the key-securing device. When the last lock is removed, the work site supervisor removes their lock from the energy-isolating device and verifies that no worker will be in danger due to the removal of the lock.
- In an emergency or if a worker who attached a lock is not available when required to remove it, the supervisor or crew leader may remove the lock in accordance with a procedure that includes verifying no workers will be in danger due to removal of the lock.

9.17.2.3 Securing by a Complex Group Control

- Only used when it is not reasonably practicable to use an individual or group control process because of various reasons and requires approval by a Director of Inspection in Alberta.

9.17.2.4 Securing Remotely Controlled Systems

- Where equipment is located such that energy-isolating devices are in remote or non-contiguous locations (e.g. process control equipment 200km away from the computer that controls it) the securing process must still provide a level of protection that is equivalent to securing by an individual or group process.
- A control system isolating device must be used in combination with written authorization.
- A control system isolating device must physically prevent activation of remotely controlled equipment. In the case of a

computer controlled system, a password does not physically prevent activation of the control system.

9.17.3 Blanking, Blinding and Double Block-and-Bleed

Blanking, blinding or double block-and-bleed systems must be in place and can be used to isolate pipes containing harmful substances under pressure.

Blanking involves inserting a physical barrier through the cross-section of a pipe so that materials are prevented from flowing past that point.

Blinding involves disconnecting a pipe and attaching a physical barrier to its end so that materials are prevented from flowing out of the pipe.

Double blocking and bleeding involve use of a three-valve system where a pipe has two closed valves and an open drain valve positioned between them so that material is prevented from flowing and is a directed in case of valve leak. The area of potential discharge from the bleed must be appropriately controlled so that it does not present a hazard. When used, a double block-and-bleed must be situated directly upstream of the work site. The valves of a double block-and-bleed must be locked out to ensure an acceptable level of safety and the bleed must be checked to ensure it remains clear of obstructions while the space is occupied.

A blind/blank (i.e. pancake, spectacle or skillet) must be installed at an isolation point closest to the area where the work will be performed (i.e. between interconnecting piping, vessels or sewers that may contain hazardous materials). When installing blinds/blanks or blind flanges ensure that the vessel or piping is completely depressurized before separating the pipe flanges. Ensure that any fluids that may be released from the flange will be contained.

Blind/blank must be rated as to size, flange and be able to withstand the expected line pressure.

Blind Rating Chart

ANSI Class	150	300	600
2”	¼”	3/8”	3/8”
3”	¼”	3/8”	3/8”
4”	3/8”	1/2”	5/8”
6”	½”	3/4”	7/8”
8”	5/8”	7/8”	1-1/8”
10”	¾”	1-1/8”	1-3/8”
12”	¾”	1-1/4”	1-5/8”
14”	7/8”	1-3/8”	1-7/8”
16”	1”	1-1/2”	2-1/8”

Electrical Isolation

- Electrical energy is locked out with a mechanical device (i.e. manually operated circuit breakers and switches and disconnect switches) that physically prevents the transmission or release of energy.
- Electrical equipment must first be shut off at the equipment itself (i.e. the local start/stop switch).
- Main power control switch at the panel must be shut off (this switch must be locked out and should be tagged). Place a lock out hasp on the breaker.
- A "bump test" must be conducted. Ensure that all workers are clear of the equipment and attempt to start the equipment at the local start/stop switch. The equipment should not start, however if it does, lock out procedures need to be reviewed (i.e. the equipment may be wired to a different breaker etc.).
- "Do Not Operate" tags should be hung on the local start/stop switch and any other associated control switches.

Where it is not possible to provide positive isolation, an alternative means of isolation and associated standard operating procedures can be used however, the procedure must be certified by a professional engineer.

9.17.4 Lock Out Checklist

There are four steps to performing safe isolation or lock-out including: isolate the location at which the work will be carried out; verify the equipment is isolated from all energy sources; lock the isolation by ensuring the energy-isolating device(s) and all relevant components are physically secured; and once the work is completed, return the system to operation. The following checklist can be used to guide operations in compliance with this HSE Program.

- ❑ Identify equipment to be isolated and all applicable isolation points.
  - This can be completed by an on-site inspection and by referring to drawings.
- ❑ A safe work permit in combination with a lock out form should be generated for construction projects and/or operations maintenance by the work site supervisor indicating all lock out and tag locations. Refer to Appendix 1, Form 18 – Safe Work Permit and Form 13 – Lock Out.
- ❑ Where appropriate, tags may be attached to all machinery locks and should state "Do Not Operate".
- ❑ If there is more than one worker working on a piece of equipment then a group lock must be used. A multiple lock adapter (scissor-clip) can be used if there is more than one worker working on a particular piece of equipment. This will allow all workers working on the piece of equipment personal protection through the use of their own lock. The locks must be traceable to the worker. Alternatively, a group lock out box with a master lock can be used.
- ❑ Once the isolation and lock out has been completed the lock out form must be signed by the work site supervisor.
- ❑ Once the safe work permit and/or lock out form is complete, the workers must

be satisfied that the equipment is properly locked out and sign the lock out form.

- ❑ Retain forms on file.
- ❑ No unauthorized person should touch anything that has to do with a locked out area. No person shall remove a lock out device except the worker who installed it. In the case of an emergency or where the worker who installed a lock is not available, the work site or crew supervisor can remove a lock after first ensuring that no worker will be endangered by the removal of the lock.
- ❑ When work is complete, the worker may remove their lock after first ensuring that no worker will be endangered by the removal of the lock. If applicable, the work site supervisor may then remove their lock after first ensuring that no worker will be endangered by the removal of the lock.
- ❑ On completion of servicing, repairs, tests or adjustments, the worker shall, before the operation of the machine is resumed, ensure that putting the machinery in motion will not endanger any worker.

9.18 Manual Lifting

9.18.1 Introduction

In Canada, manual material handling is the most common cause of occupational fatigue and low back pain. Prevention of back injuries is important. Work-related factors include the weight of the load lifted, the range of the lift, the location of the load in relation to the body, the size and shape of the load, distance and duration the load is carried, and the number and frequency of lifts performed. Excessive bending and twisting also increases the risk of back injury. For most workers, lifting over 20 kilograms results in an increased number and severity of back injuries.

9.18.2 General Considerations

If it is not reasonably practical to eliminate lifting hazards by using engineering controls, or other mechanical means, consider options such as the following to minimize the risk of injury.

- Do not lift heavy loads when seated: stand up and use larger, stronger muscles.
- Assess all material-handling tasks, and train them to ensure that the path is clear of obstructions or trip hazards when carrying items.
- Make sure that the work-space allows enough room for personnel to move about easily, without stooping or twisting.
- Minimize the distance between the load and the person doing the lifting by removing any obstacles between them or by using a turntable.
- Use height-adjustable pallet trucks or scissor lifts to keep loads off the floor and above knee height.
- Organize the starting and ending location of the lifts to limit the overall vertical distance a load has to be lifted.
- Avoid lifting below knuckle level and above shoulder level.

- Improve the grip or handles on objects being lifted. Use handholds and gripping aids.
- Split the overall weight of a load into smaller loads.
- Avoid handling uneven or unbalanced loads.
- Do not carry objects up and down stairs if two hands are needed to hold objects: keep one hand free to hold the handrail.

9.19 Lifting and Towing Devices

9.19.1 Introduction

Only competent authorized workers are to operate lifting and towing devices. Where critical lifts are involved, written lifting procedures complete with load charts are to be prepared and reviewed by a qualified person.

This section includes:

- General considerations;
- Cranes, hoists and lifting devices;
- Ropes, chains and cables; and
- Crane Log books.

9.19.2 General Considerations

- The hoisting equipment shall have make and model numbers permanently and legibly identified on all major structural, mechanical, and electrical components.
- No worker shall allow any part of their body to extend under any load lifted by a crane, side boom, or other lifting device.
- The lifting/hoisting contractor is responsible for ensuring that a competent, authorized worker (certified as required) operates all lifting equipment. The contractor must also ensure that a signalman is designated to signal the operator as necessary and to properly place and control the loads. No worker shall operate a hoist other than the designated competent, authorized worker.
- All devices used for hoisting or lifting must meet the applicable standards for design and construction and be regularly maintained, inspected and certified. This applies to all components of the lifting device. Written records of all inspection results shall be available for review.
- Lifts shall not be undertaken until the operator determines the weight of the object and ensures that any slings and lifting devices of any kind are of sufficient strength to support the weight of the load.
- Tag lines must be used to guide and control loads where excessive movement is possible.
- Do not lift unbalanced loads.
- Repairs must be performed under the direction of a professional engineer and the hoist must be tested after repair by a professional engineer to ensure the

capacity of the components is not less than the original capacity.

9.19.3 Cranes, Hoists and Lifting Devices

- Lifting devices, including cranes and hoists, with a rated load capacity of 2000 kilograms or more must follow OHS regulations.
- Lifting devices with a rated load capacity of less than 2000 kilograms must have the rated load capacity of the equipment shown on the equipment.
- The rated load capacity must be displayed on a plate or weatherproof label permanently secured to the lifting device that indicates:
  - manufacturer's rated load capacity;
  - manufacturer's name; and
  - the model, serial number and the year of manufacture or shipment date.
- If a lifting device is not commercially manufactured, it must be certified by a professional engineer that it is fit and safe for use.
- Cranes are to be operated only by designated, competent workers.
- When necessary to ensure safe hoisting operations, a designated signalman will be in constant visual communication with the crane operator. The signalman will use the manufacturer's hand signals for control of hoisting operations as per the mandatory chart attached to the crane.
- The crane must be equipped with a warning device to warn workers of the impending movement and if it is an audible alarm, it must be distinct from all other audible alarms at the work site.
- Visually inspect the lifting equipment for worn or damaged parts.
- Ensure loads are properly hooked up.
- Instruct workers to watch for pinch points when holding onto slings or hooks while the slack is being taken up.
- Use the tag lines to control load movement.
- Ensure the tag lines are of sufficient length such that any sudden movement of the load cannot strike the worker.
- A load must never be left suspended while the crane is unattended.
- When the crane is shut down, all controls should be placed in the neutral position with the brakes and rotation lock engaged.

9.19.4 Ropes, Chains, Cables

All ropes, chains and cables used in lifting, hoisting or towing must be inspected prior to use to ensure proper and safe operation. No ropes, chains or cables shall be used if they are worn, frayed, twisted or show any signs of damage or weakness. Damaged equipment must be taken out of service and sent for maintenance or disposed of.

- Any equipment used must be approved and tested for the lifting applications and at no time shall the working load exceed the maximum safe working load recommended by the manufacturer or a professional engineer.

- All ropes, chains, cables, slings or straps shall be protected from sharp edges during lifts and shall be stored properly when not in use.
- During winch or tow cable use, all workers must be clear of the “whip area” of the cable while it is under tension.

9.19.5 Crane Log Books

Log books must be maintained for each crane or hoist at a work site (electronic log books are permitted; log books are not required for manually operated hoists) and be readily available for examination in the event of an inspection and must include the following information:

- the date and time when any work was performed on the lifting device;
- length of time in lifting service:
  - recorded as hours of service if the lifting device is equipped by the manufacturer with an hour-meter, or
  - if required by the manufacturer’s specifications;
- all defects or deficiencies and when they were detected;
- inspections, including examinations, checks and tests, that are performed, including those specified in the manufacturer’s specifications;
- repairs or modifications performed;
- a record of a certification;
- any matter or incident that may affect the safe operation of the lifting device;
- any other operational information specifically identified by the employer;
- each entry in a paper log book must identify the person doing the work; and
- each entry in an electronic log book identifies the person doing the work.

9.20 Naturally Occurring Radioactive Materials (NORMs)

9.20.1 Introduction

Naturally Occurring Radioactive Materials (NORM) are radioactive elements that are found naturally in the earth’s soils and formations. These elements (uranium, radium and thorium) are radioactive and unstable due to their large proton (positively charged particles) to neutron (neutrally charged particles) imbalance. Radiation results from the natural breakdown of NORM elements. Radiation occurs in various forms such as alpha particles, beta particles, or gamma rays.

9.20.2 Definitions

Alpha Particles

- These are the largest particles of NORM. They can be stopped from entering the body by skin. There is a risk of ingestion or inhalation. Once ingested or inhaled, these particles can be absorbed by the body’s soft tissue and become

hazardous as they continue to decay. They are too large to pass through vessel walls or piping.

Beta Particles

- These particles are much smaller than alpha particles. They can be absorbed by the skin and into the soft body tissue such as the lungs. They are too large to pass through vessel walls or piping.

Gamma Rays

- Consist of a stream of electromagnetic energy waves that pass through matter unimpeded until they collide with some form of matter small enough to capture or stop the wave stream (such as the nucleus of an atom). These rays can pass through vessel walls or piping. A Geiger counter is used to determine NORM levels.

9.20.3 Radiation Hazards

Gamma Hazard

Uranium, radium and thorium are naturally occurring elements found in most producing hydrocarbon formations. As these elements decay or break down they produce radon gas which has similar properties (boiling point) to propane under process conditions. Usually the radon gas is so diluted in the raw gas stream that hazardous concentrations cannot be detected but once the gas stream is fractionated into the propane phase, the radon gas becomes more concentrated. Areas where the gas can be measured are around the de-propanizer, de-propanizer overheads and filter canisters at fractionation facilities. Unless working at a fractionation facility the threat of gamma radiation is minimal. This type of radiation is negligible outside one foot of process piping or process equipment.

In general, the following safe work procedures should be observed:

- Reduce the time spent around vessels and piping that could contain this type of radiation; and
- Maximize the distance between yourself and any vessels or piping that could contain this type of radiation.

Note: usually this type of radiation is negligible outside 1 foot of process piping or process equipment.

Alpha and Beta Hazards

As radon gas breaks down it deposits miniscule products of decay called radon daughters. NORM hazard is associated with the alpha and beta particles within the radon daughters. Radon deposits are found inside vessels and/or piping in the form of scale and sludge, and if disturbed, can be inhaled or ingested as dust. The health hazard from inhalation or ingestion is similar to that of asbestos.

In general, the following safe work procedures should be observed:

- When possible, purge suspect equipment for 48 hours prior to any maintenance. This will allow the radon daughters to decay to a more stable (less hazardous) state;
- If handling possible contaminated materials, wash hands and face (with soap and water) following the job;
- Avoid creating dust from the scale or other deposits by keeping the material wet;
- If dust is inevitable, wear an air purifying canister type respirator approved for radon daughters or radioactive dusts; and
- If working in a known NORM area, vessels should be tested for NORM prior to entry.

9.20.4 NORM Personal Protective Equipment

The following PPE is required when any work is required where NORM exposure is possible:

- Disposable gloves will be used when handling any possible NORM contaminated material;
- Fire resistant coveralls (disposable coveralls should be used whenever possible);
- Steel toed boots (should be washed off after job completion);
- Safety goggles (should be washed off after use);
- Respirators will be worn if disturbance of scale and/or sludge is expected. Recommended respirator is a Wilson 6100 Silicone face piece, a T-20 filter for dust/radon daughters, and a PR21 and RP22 filter base and retainer.

9.20.5 Storage and Disposal of NORMs

Place any suspected NORM contaminated material (scale, sludge, contaminated PPE, etc.) in a plastic bag and then into a steel drum with a sealed lid and label the drum “NORM CONTAMINATED MATERIAL”. Once the drum is sealed, store in a secure area and contact Pieridae’s waste contractor for pick up. Be sure to identify the material as NORM before pick-up as not every waste disposal company will accept NORM waste.

9.21 Office Safety

9.21.1 Precautions

Personnel working in an office environment should observe the following precautions:

- Each worker shall be familiar with the location of the fire alarm pull station nearest to their workstation.
- Each worker must become familiar with the appropriate evacuation route for

their workstation. Evacuation routes for each floor and building area must be clearly marked in prominent locations (typically near the elevator, if applicable).

- During fire alarms, Fire Wardens should make last-minute searches of their areas to ensure all personnel are evacuated. Workers can help the Fire Wardens by clearing the area quickly and providing assistance if requested. If a Fire Warden requests a worker to leave a work area it must be done immediately.
- During evacuations do not use the elevators. Use stairwells, following the nearest exit signs and evacuation drawings. Check closed doors for temperature and smoke before opening.
- Keep all passageways, entryways, aisles, storerooms, service rooms, and work areas clean, orderly, sanitary and well maintained with no obstructions.
- Aisles and hallways shall provide unobstructed movement and immediate access for fire protection personnel and equipment.
- Keep flammable or combustible material and residue in a building or operating area to a minimum. Store flammable materials in metal safety cans or storage cabinets that meet applicable regulations.
- Safely stack material boxes (limiting height appropriately) without blocking sprinkler heads, fire exits, fire extinguishers, electrical control panels, etc.
- File drawers and desk drawers should not be left open. Do not overload top drawers so that cabinets tip over.

9.21.2 Workstation Ergonomic Tips (Sitting and Standing)

If you are a new employee or moving to a new workstation, follow these four easy steps to help set up your computer workstation. Training will be provided when setting up a new workstation.

Step 1: Chair

- Push your hips as far back as they can go in the chair.
- Adjust the seat height so your feet are flat on the floor and your knees are equal to, or slightly lower than, your hips.
- Adjust the back of the chair to a 100°-110° reclined angle. Make sure your upper and lower back are supported. Use inflatable cushions or small pillows if necessary. If you have an active back mechanism on your chair, use it to make frequent position changes.
- Adjust the armrests so that your shoulders are relaxed. If your armrests are in the way, remove them.

Step 2: Keyboard

- An articulating keyboard tray can provide optimal positioning of input devices. However, it should accommodate the mouse, provide leg clearance, and have an adjustable height and tilt mechanism. The tray should not push you too far away from other work materials such as your telephone.
- Pull up close to your keyboard.
- Position the keyboard directly in front of your body.

- Determine what section of the board you use most frequently, and readjust the keyboard so that section is centered with your body.
- Adjust the keyboard height so that your shoulders are relaxed, your elbows are in a slightly open position (100°-110°), and your wrists and hands are straight.
- The tilt of your keyboard is dependent upon your sitting position. Use the keyboard tray mechanism, or keyboard feet, to adjust the tilt. If you sit in a forward or upright position, try tilting your keyboard away from you at a negative angle. If you are reclined, a slight positive tilt will help maintain a straight wrist position.

- Palm support can help to maintain neutral postures and pad hard surfaces. However, the palm support should only be used to rest the palms of the hands between keystrokes. Resting on the palm support while typing is not recommended. Avoid using excessively wide palm support, or palm support that is higher than the space bar of your keyboard.
- Place the pointer as close as possible to the keyboard. Placing it on a slightly inclined surface, or using it on a mouse-bridge placed over the 10-keypad, can help to bring it closer.

- If you do not have a fully adjustable keyboard tray, you may need to adjust your workstation height, the height of your chair, or use a seat cushion to get in a comfortable position. Remember to use a footrest if your feet dangle.

Step 3: Monitor, Documents, and Telephone

- Incorrect positioning of the screen and source documents can result in awkward postures. Adjust the monitor and source documents so that your neck is in a neutral and relaxed position.
- Center the monitor directly in front of you above your keyboard.
- Position the top of the monitor approximately 2-3" above seated eye level. (If you wear bifocals, lower the monitor to a comfortable reading level.)

- Sit at least an arm's length away from the screen and then adjust the distance for your vision.
- Reduce glare by careful positioning of the screen. Place screen at right angles to windows. Adjust curtains or blinds as needed. Adjust the vertical screen angle and screen controls to minimize glare from overhead lights. Other techniques to reduce glare include use of optical glass glare filters, light filters, or secondary task lights.
- Position source documents directly in front of you, between the monitor and the keyboard, using an in-line copy stand. If there is insufficient space, place source documents on a document holder positioned adjacent to the monitor.
- Place your telephone within easy reach. Telephone stands or arms can help. Use a headset or speaker phone to eliminate cradling the handset. Avoid tilting head to hold a telephone receiver between head and shoulder.

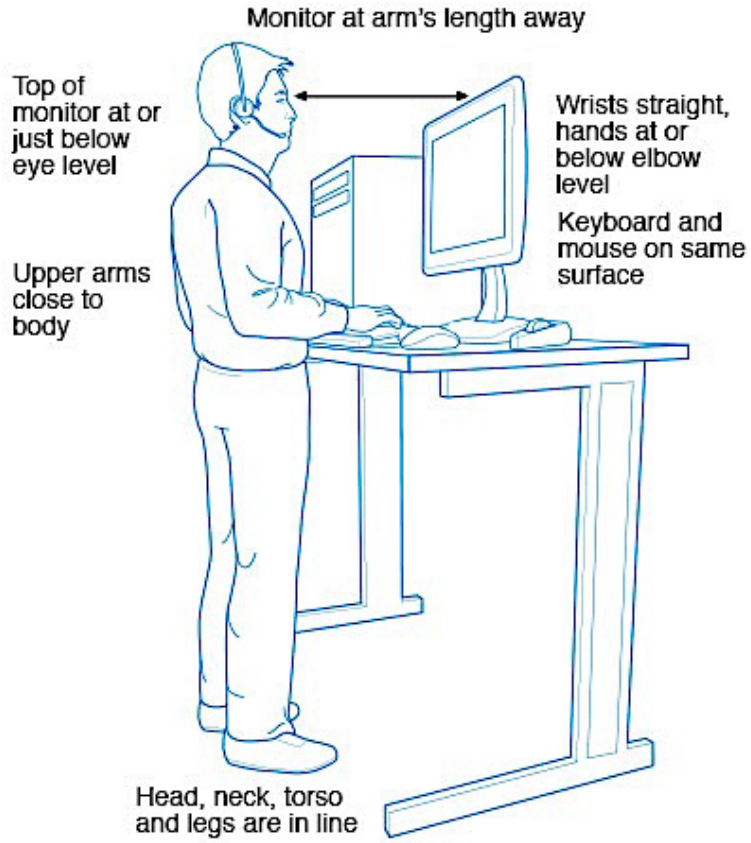
Step 4: Pauses and Breaks

- Once you have correctly set up your computer workstation use good work habits. No matter how perfect the environment, prolonged static postures will inhibit blood circulation and take a toll on your body.
- Take short 1-2 minute stretch breaks every 20-30 minutes. After each hour of work, take a break or change tasks for at least 5-10 minutes. Always try to get away from your computer during lunch breaks.
- Avoid eye fatigue by resting and refocusing your eyes periodically. Look away from the monitor and focus on something in the distance. To minimize computer eye strain, practice the 20-20-20 rule: after 20 minutes' work look 20 feet away for 20 seconds. Rest your eyes by covering them with your palms for 10-15 seconds.
- Use correct posture when working. Keep moving as much as possible.
- Adjust chair height so that your upper legs are horizontal and feet are flat on floor.
- Adjust chair to sit up straight and obtain proper back support.
- Avoid tilting or turning head to view a computer monitor.
- Avoid tilting head to hold a telephone receiver between head and shoulder.

- Ensure forearms and wrists are level when keyboarding.
- Avoid resting hands, wrists and arms on hard or sharp edges when keyboarding.
- Ensure computer table is just below forearm/wrist height.
- Ensure that the work station provides adequate leg room.
- Keep arms resting comfortably at sides and shoulders relaxed.
- Place keyboard and mouse at a comfortable distance from the body.
- Place frequently used items within easy reach.
- Alternate tasks to break up extended periods on the computer.
- To minimize computer eye strain, practice the 20-20-20 rule: after 20 minutes work look 20 feet away for 20 seconds.

Standing Workstation

- Posture: keep your head, neck, torso and legs approximately in line and vertical. Use a footrest to shift your weight from foot to foot. Wear shoes that provide proper support.
- Desk: choose a desk deep enough to allow your monitor to fit directly in front of you and at least 20 in (51 cm) away. The desk should allow you to keep your wrists straight and your hands at, or slightly below, the level of your elbows. A desk with a rounded front will prevent pressure on your wrists. Don't use books or boards to change the height of your desk.
- Monitor: place the monitor directly in front of you, about an arm's length away. The top of the screen should be at, or slightly, below eye level. If you wear bifocals, lower the monitor an additional 3-5 cm for more comfortable viewing. Place your monitor so that the brightest light source is to the side. If you have dual monitors, the location of the monitors depends on the percentage of time you spend on each monitor and the type of work being done. If you use both monitors equally, place them close together on an angle in front of you with their edges touching. If you use one monitor more than 80% of the time, place that monitor directly in front of you and the other monitor off to the side.
- Keyboard/mouse: place your mouse and keyboard on the same surface and at a distance that allows you to keep your elbows close to your body. While typing or using your mouse, keep your wrists straight, your upper arms close to your body, and your hands at or slightly below the level of your elbows. Use keyboard shortcuts to reduce extended mouse use. If possible, adjust the sensitivity of the mouse so that you can use a light touch to operate it. Alternate the hand you use to operate the mouse by moving the mouse to the other side of your keyboard.
- Key objects: keep key objects (telephone, stapler, printed materials) close to your body to prevent excessive stretching. If you frequently talk on the phone and type or write at the same time, place your phone on speaker or use a headset rather than cradling the phone between your head and neck.



9.21.3 Workplace Security

- Keep items of value secure in a locked file or desk drawer.
- Lock/secure laptops properly.
- Wear badges or identification cards so that they are visible when required by location management.
- Review security and operating procedures as provided by location management.
- Greet strangers at the workplace to confirm identification and purpose of visit.
- Use door locks, gates etc. as provided. Alarm systems should be tested and working according to specifications.
- Ensure someone is responsible to check doors, windows, gates etc. every night for proper closure and locking.

9.22 Plant Installations

9.22.1 Introduction

Plant installations are installations associated with oil and gas separation units, pipelines, pumping units and gas compressor units. The following sections provide general information however project managers and/or facility process engineers can provide specific information and specifications.

9.22.2 General

- In order to obstruct unauthorized entry, the facilities should be fenced; however safe access and egress must be maintained.
- Safe work permitting procedures must be followed.
- Adequate firefighting and safety equipment must be available, regularly inspected and ready for use.

9.22.3 Air Compressors

- The intake for the compressors must be free from an area where potential contamination from hydrocarbons or other contaminants could occur.
- Water and oil accumulation must be drained away from air storage tanks at least once daily.
- Air receivers must be equipped with safety valves and will be tested at frequent intervals.
- Belt drives must be fire resistant and anti-static. All drives must be adequately guarded.
- Crankcase and distance pieces must be vented outside buildings.
- All compressors must be equipped with emergency shut down.

9.22.4 Bleeder Valves

- A means of relieving pressure from all lines and vessels must be provided. Relief lines must be piped and secured to the outside of buildings at a level which will not cause a hazard to operators in consideration of both wind direction and possible ignition sources.
- No elbows, tees or other obstructions will be connected to the ends of the relief lines from pressure vessels or any other installation that relieves water, oil, steam or gas pressure. In cases where ABSA exempts the requirement not to use elbows for the special circumstances of operator and ignition safety, elbows can be used as long as covers are installed to keep rain and moisture out.
- All relief lines must be marked in a conspicuous manner to be easily seen and identified as such.

9.22.5 Flare Stacks

- Flare pits are not to be used under any circumstances.

- Flare stacks or tanks equipped with an above ground flare knock out drum should be used instead of flare pits.
- Flare stacks should be lit from the upwind side.
- All lines connecting a vessel to a flare stack will be blanked off before any work is performed within a vessel or on associated piping.

9.22.6 Pressure Vessels (ABSA – Alberta Boiler's Safety Association)

- All pressure vessels and pressure piping systems shall be constructed, tested and installed in accordance with the applicable specifications, standards and regulations.
- Prior to use, an Inspector, qualified by the Alberta Boiler's Safety Association, or equivalent, must inspect and approve any new vessels. Repairs, welds or alterations performed on a pressure vessel must be re-inspected by a qualified inspector prior to reuse.
- A list of pressure vessels must be maintained to ensure that proper dates for vessel re-inspection and maintenance are followed.
- Inspection certificates must be kept on file at the facility in the event that an inspector requests to examine past records.
- For more detailed information refer to the Pieridae Quality Assurance Manual.

9.22.7 Pressure Safety Valves (PSV's)

- An operating procedure as per ABSA regulations must be in place. The testing, removal from service, repair and maintenance of PSVs must be performed in accordance with the procedures.
- All gas separators must be equipped with at least one PSV that will be set to pop at a safe pressure. Each valve will be tested at frequent intervals to ensure safe operation. The repair and maintenance of pop valves is to be carried out by qualified authorized personnel only.
- No PSV may be taken out of service at any time without the approval of the work site supervisor (a safe work permit should be used for this purpose). No PSV may be taken out of service without fully depressurizing the connected lines.
- For any PSV that is taken out of service, logs must show the following information: equipment number and location; date removed and the reason for the removal; serial number and set pressure.

9.22.8 Lighting a Burner

- Ensure that the burner is gas free by checking the pilot and main valve to ensure they are closed. Permit the firebox to purge for five minutes before re-lighting the pilot.
- Use a standard length torch (62 – 76cm) for lighting. Do not carry a lighted torch from one heater to another.
- Place the torch in the proper position near the pilot light.
- Stand to one side while inserting the torch and opening the pilot valve. Do not use a methanol soaked rag.

- Open the fuel valve slowly.
- Adjust the flame to burn bright blue by regulating the dampers on burners and stacks.
- Watch pressure carefully on gas or fuel supply to detect any indication of obstructions.

9.22.9 Internal Combustion Engines

- Flammable substances can give off vapors under the right conditions. If flammable vapors enter an internal combustion engine, the engine runs faster, overheats, and can explode. Whenever possible, internal combustion engines should be located outside the hazardous location.
- Internal combustion engines can provide a source of ignition for flammable mixtures and it is therefore necessary to control their operation and movement in hazardous areas.
- Whenever possible internal combustion engines should be installed or operated in non-hazardous areas only.
- Motorized vehicles must be controlled in hazardous areas and a safe work (hot work) permit and hot work procedures should be followed.
- Engines should be mounted above ground to prevent accumulation of flammable vapor.
- Internal combustion engines should not be permanently installed within tank compounds.
- Fuel storage should be located remotely from the engine. An emergency shut off valve should be installed in the fuel line remotely from the engine.
- Emergency shut down mechanisms should be installed locally to and remotely from the engine.
- A separating wall should be considered between engines and driven equipment containing sealed sleeves through which piston rods pass.
- Ignition systems must be shielded.
- Flammable gas or smoke detection equipment should be used for alarm and shut down purposes.

9.22.10 Manifolds

- Manifolds should be installed so that, in the event of leakage, pockets of gas will not accumulate around them.

9.22.11 Portable Heaters

- Only competent workers are to install, ignite and service portable heaters in accordance with the manufacturer's instructions.
- Portable heaters are to be used only for the service which they are approved or classified.
- A safe work permit must be obtained before portable heaters are ignited or put in to service. Refer to Section 9.14 Hot Work.

- Adequate ventilation must be assured to prevent the build up of hazardous exhaust gases.
- All flammable materials and substances are to be removed from the immediate area.
- Open flame equipment is not to be located or operated in Division 1 of any class or a Division 2 hazardous location of any class unless it is totally enclosed and the air intake and exhaust are equipped with a flame arresting device. Refer to 9.6.6 Hazardous Locations.

9.22.12 Scaffolds

- Scaffolds must be constructed in accordance with applicable legislated regulations and be erected by competent workers.
- Vertical supports must be plumb and must rest on a firm surface.
- Working surfaces must be horizontal and secured against movement.
- Guardrails are required for all working surfaces above 3 metres.
- Rolling scaffolds must be used on smooth, level surfaces and must not be ridden when moved.
- The built-in scaffold ladder is the only accepted means of access and egress.

9.22.13 Illumination

- When doing any job, work site supervisors must ensure that there is enough illumination to safely enable work to be done. It is especially important when:
  - In facility yards (gas plants);
  - Mobile equipment is being used;
  - Work is being carried out in a trench or excavation;
  - Confined space entry work is being completed (lighting must be appropriate for the task); and
  - Excavating near buried pipelines, fittings, piping, cable conduit, or other buried structures.

9.22.14 Excavations

- Excavations must be properly shored, cutback, barricaded or fenced.
- Before any work commences on an excavation or trench, the work site supervisor will follow the ground disturbance procedure. Refer to Section 9.12 Ground Disturbance.

9.22.15 Compressed Gas Cylinders

- Compressed gas cylinders must be stored in accordance with manufacturer's specifications.
- Storage area must be located away from general traffic paths and not adjacent to vehicle paths.
- Cylinder storage areas are to be divided into areas marked as "full" and

"empty".

- Appropriate measures must be taken to separate cylinders containing substances, which, if mixed, could produce an explosive hazard.
- When not in use, cylinder valves are to be closed, and connecting hoses are to be depressurized.
- Cylinders must have valve protection caps in place whenever they are not connected for use or while they are being transported.
- Whether empty or full, all cylinders are to be stored, transported and used in the upright position.
- Cylinders will be secured to some substantial stationary object or by another suitable means capable of supporting the full weight of the cylinder.
- All compressed gas cylinders must be returned promptly to a suitable storage area after use.

9.22.16 Machine Guarding

- All machines, including pumpjacks, with exposed moving parts must have guarding, be properly installed and maintained. A safeguard is a guard, shield, guardrail, fence, gate, barrier, or wire mesh designed to protect the safety of workers.
- Safeguards must be installed where there are moving belts, rollers, gears, drive-shafts, pulleys, sprockets, chains, ropes, flywheels, or any other machinery where a worker could come into contact with reciprocating, rotating or moving parts of machinery.
- Adequate and appropriate warning signs are to be in place that provide clear instructions to workers concerning the nature of the hazard at each access point to machinery that starts automatically.
- No safeguards shall be removed unless it is necessary for maintenance, tests or repairs. A lock out must then be used on the applicable machine during such maintenance, tests or repairs.
- After completion of repairs or maintenance to machinery and prior to startup, a visual inspection will be completed. The inspection will include checking guards to ensure that they have been re-installed and adjusted properly.
- Where it is possible for failure of equipment to pose hazards to workers, safeguards strong enough to contain or deflect the shock and broken parts of the machinery must be installed.
- All hair, jewelry, and loose clothing that could get caught up in rotating equipment must be cut or tied back, removed, and changed, respectively, to prevent injuries to the worker.

9.22.17 Equipment Modifications

- All equipment modifications must be approved by a professional engineer employed with or under the direction of Pieridae. Refer to Section 6.5 Management of Change.

9.23 Pipeline Integrity

9.23.1 Refer to Pieridae Pipeline Integrity Management Program manual

9.24 Safe Driving

9.24.1 Introduction

The purpose of this section is to provide basic information and outline expectations of employees that drive company vehicles and/or drive rental vehicles on company business.

This section will cover:

- Requirements to drive a vehicle;
- Vehicle inspection checklist (including driver requirements, safety equipment, other equipment and vehicle equipment);
- Training;
- Maintenance;
- General rules;
- Radio controlled roads; and
- Incident reporting.

Emphasis on driver safety is high as operations staff generally drive year round in all weather conditions. The benefits of fleet safety awareness impact the attitudes of employees both on the job and at home. It can also help reduce risky and aggressive personal behaviors from spilling over into work environments.

9.24.2 Driver's License

Individuals directly involved with field operations must maintain a provincially issued Driver's License. As a condition of initial employment with Pieridae and a requirement for continued employment with Pieridae, employees and contract operators must possess and continue to possess a valid provincially issued Driver's License. Following acceptance of employment with Pieridae, a current driver's abstract must be provided. Abstracts will be required periodically. Drivers must follow motor-vehicle laws and regulations.

9.24.3 Vehicle Inspection

Refer to Section 7.4 Vehicle Inspection and Appendix 1, Form 23 – Vehicle Inspection Checklist. The checklist should be used when outfitting a new company vehicle or for inspections of company owned vehicles at a frequency determined by management. Rental vehicles will not have all equipment; however, the driver should refer to the checklist and as a minimum have insurance, registration, a valid

driver's license and suitable clothing for the conditions. The following is a list of items that should be used for reference:

Driver

- Driver's license;
- Registration card;
- Insurance card (pink card);
- TDG Exemption Permits (production operators);
- HSE Program (hardcopy and/or access to electronic copy); and
- Emergency phone list (for applicable operating area).

Safety Equipment

- Cell phone (production operators - with booster and radio);
- Fire extinguisher (production operators – 30lb extinguisher with installation bracket);
- Respiratory equipment/breathing air (if required);
- First aid kit (production operators - Type No. 1 Kit);
- Flashlight – all weather, intrinsically safe (production operators); and
- Survival kit – may include: water, food, stove/fuel, waterproof matches, candles and hot packs (optional – as deemed appropriate for applicable operating area).

Other Equipment

- Booster cables (production operators – 20ft booster cables);
- Tow rope/strap (production operators – e.g. Ditch Hitch Tow Kit);
- Shovel (production operators e.g. long handled spade); and
- Suitable winter clothing (as deemed appropriate).

Vehicle Operation Equipment

- Headlights;
- Tail lights;
- Brake lights;
- Back up lights;
- Signal lights;
- Windshield wipers;
- Windshield condition;
- Windshield washer fluid level;
- Oil level;
- Fuel level;
- Tire condition and spare tire; and

- Seatbelts.

9.24.4 Training

Pieridae does not specifically require that employees that drive company vehicles take a defensive driving course although driving courses may be periodically scheduled as arranged and approved by management. Additionally, a new driver may be required to take a driver training course.

9.24.5 Vehicle Maintenance

Company-owned vehicle maintenance procedures will be developed for each operating area and will be dependent on typical road conditions and kilometres traveled. Proper use of fleet gas cards and/or company credit cards is important.

9.24.6 Safe Driving Rules

- Abide motor-vehicle laws and regulations.
- Obey distracted driving laws and regulations.
- Follow traffic posted traffic signs and signals.
- Drive defensively.
- Wear a seatbelt at all times.
- Adjust seat and controls as required.
- Use proper driving techniques.
- Be courteous.
- Do not drive a company vehicle or a leased or rental vehicle on company business under the influence of drugs or alcohol.
- Company vehicles or leased and rental vehicles are only to be driven on company business.
- Drive with lights on at all times.

9.24.7 Radio Controlled Roads

Some roads may be private and may be radio controlled. The road use protocol must be followed including: posted/designated speed limits; must calls; and incident reporting. Each owner may have a different protocol. This information can be obtained from the surface land department as part of the surface land agreements in place with the owners.

As a minimum, Pieridae will dispatch workers with clear instructions about radio controlled roads and the road use requirements.

When there are high activity levels on radio controlled roads, it may be necessary to use the simultaneous operations (SIMOPS) procedure to coordinate activities and/or traffic. Refer to Section 6.3.2 SIMOPS.

9.24.8 Vehicle Incident Reporting

In case of a vehicle incident a vehicle accident report form must be completed in accordance with Section 12.0 Incident Reporting and Investigation. Refer to Appendix 1, Form 11c – Vehicle Accident Report. There may be an additional requirement to complete a Worker's Compensation Board (WCB) vehicle accident report.

The following steps should be taken in the event of a vehicle accident:

- Pull off the road, if possible, to avoid obstructing traffic.
- Place warning reflectors on the road as necessary.
- Render aid to any person who may be injured.
- Obtain the name and contact information of all other motorists involved in the accident (driver's name, license number, and contact information; license plate number and year make and model of the vehicle; if the vehicle is not from BC obtain the insurance details including the name of the insurance company and contact information).
- Remain calm. Do not enter into any argument or dispute with the driver or occupants of other vehicles that may be involved, pedestrians or bystanders.
- Make no admission of liability or offer any settlement of claims.
- Report the accident to your supervisor as soon as possible.
- Report the accident to the RCMP if required (in Alberta, if there is an injury or the combined damage to the vehicle or vehicle(s) is greater than $2,000).
- In BC, report the incident to ICBC.
- In AB, report the incident to the vehicle insurer as noted on the insurance pink card.

9.25 Safety Device Bypassing

9.25.1 Introduction

Signs, labels and barricades will be placed to easily identify present and potential hazards. The type of identification used will be dependent on which method provides the most effective protection.

Application on bypasses to safety devices and systems is required, often to complete preventative maintenance activities (for example, calibration of input devices, online change-outs of pressure relieving devices, start up of facilities, or to respond to and isolate a failed safety device). Refer to PEIMS.

Specific procedures must be followed when bypassing safety devices under certain specific circumstances. The application of bypasses to an instrument or safety device allows personnel to negate the functionality of safely shutting down process equipment, or responding to an abnormal or unsafe operating condition or loss of containment. There will be an increased risk during the time the bypass is

applied, which needs to be properly assessed. The appropriate mitigation measures and safeguards must then be implemented to ensure the task or situation requiring the bypass can be done so safely.

While this standard applies to the bypassing of installed safety devices and systems inherent to the process, it does not address deviations from operating procedures, non-process equipment, or administrative safeguards and requirements.

This standard also applies to equipment temporarily installed in the process (for example, temporarily installed equipment, or systems introducing pressure to a system such as pumping units, pressure trucks, combo units, hot oilers, and N2 bulkers), whether owned, leased, or contracted by Pieridae, to ensure no safety devices are bypassed resulting in unsafe conditions or damage to company facilities.

9.26 Silica (Crystalline Silica)

9.26.1 Introduction

Silica is the scientific name for a group of minerals made of silicon and oxygen. Silica is found in most mineral deposits in the world in both crystalline and non-crystalline (amorphous) forms. Crystalline silica has its oxygen and silicon atoms arranged in a three-dimensional repeating pattern. Amorphous forms of silica have a random pattern. Crystalline silica occurs in several forms, including quartz, cristobalite and tridymite. Quartz is the most common form of crystalline silica. It is the crystalline form of silica that is the main concern when considering health effects.

Many dusts contain crystalline silica, a mineral that makes up nearly all of what is called sand and rock. It's in masonry, tiles, granite, brick, concrete, grout, mortar, paint and asphalt. It's also in abrasives used in blasting, the dust on roads and the sand used in oilfield operations. When dormant, silica is harmless, but when disturbed, airborne and inhaled it can become a health hazard.

Silicosis is caused when crystalline silica particles less than 10 microns in diameter are inhaled and deposited in the lungs. This is known as "respirable" silica. Lung tissue reacts by developing lumps and scarring around the trapped silica particles. If the lumps and scar tissue grow too large, breathing becomes difficult and death may result.

Factors that influence the development of silicosis include: particle type e.g. quartz, particle size — particles larger than 10 microns in diameter tend to be deposited in the nose or throat rather than the lungs, how long a person is exposed to silica dust, the concentration of silica dust in the air, and individual susceptibility.

9.26.2 Tasks/Locations

Silica can be found when completing the following tasks: sand storage inloading, fill and vent nozzles, conveyor junctions, hopper, disturbing silica powder, truck bottom dump and sand tent.

9.26.3 Signage and PPE

Refer to the hierarchy of controls.

Where it is not possible to eliminate the hazard ensure time and distance away from the hazard (mark restricted areas with appropriate signage such as “Silica Hazard” or “Restricted Area” with appropriate signage. Appropriate APR’s will be worn where required.

9.27 Signs, Labels and Barricades

9.27.1 Introduction

Signs, labels and barricades will be placed to easily identify present and potential hazards. The type of identification used will be dependent on which method provides the most effective protection.

9.27.2 Facility Signs

As per AER Oil and Gas Conservation Act Regulation, Pieridae will identify a facility by the use of a conspicuous sign erected at the primary entrance to a facility that identifies:

- Name and emergency telephone number;
- The LSD of the surface location; and
- Warning symbols appropriate to the hazards at the facility (i.e. H_2S, flammable gas, etc.).

9.27.3 Pipeline Marker Signs

AER/CSA pipeline warning sign standards will be followed. Signs must be erected where a pipeline crosses a highway, road, railway or watercourse at each side of the crossing. Warning signs will also be used to identify all above ground pipeline facilities (i.e. meter and regulator stations, valves, field manifolds and line heaters) and will be erected adjacent to the facility in each case. All pertinent data on signs must be accurate. Approved signage contains the following information:

- The world “Warning”, “Caution”, or “Danger” must be prominently displayed;
- The type of pipeline system must be prominently displayed (i.e. “High-Pressure Natural Gas Pipeline”, Sour Gas Pipeline”);
- Licensee’s name and/or operator’s name;
- Phone number for immediate emergency response;
- Company logo may be added;
- If applicable (i.e. high vapor pressure pipelines), the sign must display the name of the highest vapor pressure product shipped and may display the wording “High Pressure” and “Flammable Liquids”;
- For non-high vapor pressure pipelines “High Pressure” may also be used; and
- Signs should also include a statement such as “Call before you dig” or “Call for locate”.

9.27.4 Work Site (General)

Throughout the work site, site specific hazards may be present. All hazard areas must have adequate signage and be labeled and barricaded as required. Examples include:

- Pipelines, piping systems and manifolds to indicate the substance within;
- Pipeline crossings;
- Major valves (with on and off positions clearly marked);
- Noise hazards (provide clear instruction that hearing protection is required);
- Poisonous gas (H_2S);
- Open pits/excavations;
- Personal protective equipment requirements (hearing protection, safety glasses, face shield etc.);
- Electrical hazards, including overhead power lines. Refer to Section 9.6.3 Electrical Standoff;
- WHMIS;
- Overhead hazards;
- Location of first aid stations, eye wash stations, firefighting equipment;
- Emergency shutdown devices (ESD’s); and
- Equipment that starts automatically (provide clear instruction on the equipment that starts automatically and on building doors, if applicable).

9.28 Security and Crime Prevention

Refer to the Corporate Security Plan.

To prevent crime, personnel must be thoroughly aware of their environment. Tips include:

- Be alert.
- Know your surroundings.
- Use gates, locks and security systems as may be appropriate.
- Trust your intuition.
- Call for back up and/or report suspicious circumstances.
- Exercise care and caution at all times.
- Call RCMP when needed.

9.29 Tank Gauging

9.29.1 Introduction

There are inherent hazards associated with gauging tanks. This procedure has been developed to alert workers to safe procedures when performing tank gauging operations.

9.29.2 General Considerations

- Do not run on stairways and walkways.
- In an area where H_2S is present, wear appropriate respiratory protection and take necessary precautions prior to entering diked areas and/or climbing tanks.
- Approach the thief hatch from the up-wind side whenever possible.
- No workers are to be permitted to walk on top of any tank. Thief hatches are to be properly closed when not in use and will be opened as infrequently as possible, consistent with obtaining tank levels for control of tank inventory and tank filling. If a tank is fitted with more than one thief hatch, only one is to be opened at a time.
- Manual gauging is not to be carried out when atmospheric conditions are liable to cause static or other hazards to workers engaged in the operations, such as electric storm, hail or flying sand.
- Care is to be taken to avoid unnecessary inhalation of vapor from petroleum products. A worker required to climb to the top of a storage tank is likely to be breathing deeply on arrival and should rest briefly prior to opening a gauging hatch. When gauging, sampling or taking temperatures, the workers head should be turned to avoid breathing directly over the opening.

9.30 Truck Loading/Unloading

9.30.1 Introduction

Workers must exercise caution when working around truck loading areas. A safe work permit should be issued to contractors for truck loading (a blanket safe work permit can be issued). A site specific procedure can also be developed and attached to the safe work permit or be posted at the loading area. Consideration

must be given to atmospheric testing, and if it is not readily available and depending on the nature of the product being loaded, truck drivers should wear adequate personal monitors.

The following procedures will be followed by the contractor (trucking company) conducting the loading, however it is important that Pieridae employees have a base knowledge of the procedure.

9.30.2 General Considerations

- A procedural sign should be placed at the loading area.
- Adequate firefighting equipment must be available in the loading area.
- Loading operations should be discontinued during electrical storms.
- Smoking, open lights or fires are not permitted in loading and unloading areas.
- All diesel tank trucks must have an adequate air intake shut-off valve or system for injecting an inert gas into the engine's cylinders.
- Prevent spills, drips and leaks.
- After the truck has been moved to a loading position, all lights, radios and fans should be turned off. No switches on the truck will be turned on or off unless absolutely necessary during loading operations.
- The driver and any riders are to leave the truck cab and not return to the cab unless authorized by the loader or loading is completed and the truck is ready to leave.
- Place chocks or blocks at the front and back of rear wheels of the tank truck before making any loading connections.
- A ground cable must be attached to the tank, making sure that good metal to metal contact is obtained.
- Truck drivers must connect vent return lines between the vehicle tank and the storage vessel. If a vapor return line is used during loading, the driver must ensure that the truck is adequately purged before loading.
- Workers will discharge any static electrical charge that may be present by touching part of the metal loading clamp, handrail or equipment with bare hands prior to connecting the hoses.
- Where tank trucks are being loaded through dome hatches and it is necessary to observe the fluid level:
  - A platform is to be provided for the loader with sufficient fall protection.
  - Shut off controls will be located on the platform.
  - Adequate illumination will be provided.
  - Personal protection SCBA will be used when the atmospheric H_2S conditions are over 10ppm.
  - Close the dome disconnect loading and vent lines before disconnecting the ground cable between loading truck and product tank.
- The maximum permitted filling density must not be exceeded under any

circumstances.

- LPG and oil load out valve sites exterior to any facility fenced perimeters should be recessed in the fence or barricaded to prevent damage by vehicles.
- Enviro-boxes or drip pans are to be placed under load out valves to prevent long-term ground contamination (secondary containment).
- No servicing or maintenance will be carried out on a tank truck during the loading or unloading of hydrocarbons.
- While tank trucks containing flammable, vaporizing liquids are being connected or disconnected, no vehicle shall start up or have its motor running in the loading area.
- Workers and truck drivers must use intrinsically safe flashlights.
- A constant check must be maintained on tanks, hoses, valves, lines and other loading equipment to prevent and detect leaks.

9.30.3 Sour Product (H_2S) Loading

- In addition to the truck loading/unloading general considerations, additional precautions must be taken when handling sour products. Refer to Section 9.16 Hydrogen Sulphide (H_2S).
- Where there is a potential for the product being handled or transported to contain H_2S, the carrier must be notified prior to arriving onsite.
- Workers handling or transporting sour products will have a valid H_2S certification when working on Pieridae work sites.
- Workers handling or transporting bulk sour product shall ensure that shipping documentation and placarding is in accordance with the legislative requirements.
- Respiratory protective equipment must be available at a site, or in the vehicle, when sour products are being loaded or unloaded.

9.31 Welding

9.31.1 Introduction

Only qualified personnel will operate welding equipment. Welding hazards are controlled by using proper ventilation, respirators and other personal protective equipment and clothing and by following standard operating procedures. A safe work permit must be completed for welding activities (hot work). Before welding starts, an inspection of the area surrounding the welding operation must be carried out and combustible, flammable and explosive material, dust, gases, or vapors that are present or are likely to be present in the work location must be identified and controlled.

9.31.2 General Considerations

- Complete a safe work permit.

- Ensure the welder and the helper wears personal protective equipment. Both the welder and the helper should wear goggles, helmets, hand shields and barriers during arc welding or cutting operations. Except when engaged in light work, welders should also wear flameproof gauntlet-style gloves, flameproof and radiation-proof aprons, flame resistant clothing, high boots or metal screens in front the legs.
- Be alert to possible fire hazards.
- Warn any other workers who may be in the same area against welding flashes or hot sparks.
- If a confined space must be entered follow the confined space procedures and ensure appropriate confined space permits are completed. Refer to Section 9.5 Confined Space Entry.
- Ensure fire extinguishers are readily available.
- Check the ventilation system before starting work and periodically thereafter to ensure that it is working properly.
- When working overhead, rope off the areas below or take equivalent measures. This is to protect the workers below from hot slag, particularly when working on scaffolds.
- Keep cylinders, cylinder valves and cylinder regulators free from oil, grease or soap.

9.32 Wildlife Awareness

9.32.1 Introduction

This procedure is intended provide information for workers who work outdoors or plan for working outdoors. Working outdoors in the wild increases the likelihood of encountering wildlife, including bears, cougars, wolves, moose, deer, mice (Hanta Virus), ticks (Lyme Disease), etc. Working outdoors involves entering wildlife habitat where the opportunity for encountering wildlife increases. Workers must be respectful of habitat and wildlife and leave as little trace as possible. The opportunity for conflict also exists. It is important have a respectful attitude towards all wildlife in and around the work site and to prevent encounters. Local Fish and Wildlife Officers are a valuable resource and can provide information on protected species in the area, carnivores whose territory overlaps with the work site, and other issues (such as reporting habituated wildlife or poaching etc.).

Field wildlife mitigations rely on workers being properly equipped, trained and aware of wildlife behavior.

9.32.2 General Considerations

To prepare for working in an area where wildlife is present, certain factors should be evaluated including:

- Species present in an area;

- Protection status of species;
- Likelihood of an encounter;
- Risk of an encounter;
- Time of day most likely to encounter species;
- Time of year most likely to encounter species (seasonality: breeding season/rut; birth/with young etc.)
- Species territory requirements;
- Hazards presented by wildlife in the area (including vehicle/animal hits);
- Plan for controlling food storage;
- Planning for controlling garbage storage and disposal;
- Communicating hazards to workers;
- Effective bear spray use;
- Recommended actions in case of an encounter;
- Fencing requirements;
- Working alone;
- ERPs.

Much of the planning is covered by this HSE Program and/or regulatory procedures. Pieridae does not have a stand-alone wildlife management plan and instead work site supervisors will consider wildlife hazards and controls as part of existing processes. Refer to Section 6.1.7 Job Hazard Analysis and Site Specific Procedures and Section 6.2 Safe Work Permits.

Specific considerations include:

- Comply with wildlife-related acts, wildlife protection plans, and any specific approval conditions.
- Where appropriate complete a job hazard analysis and develop site specific procedures where necessary.
- Communicate hazards and controls to contractors via the safe work permit process and/or safety meetings.
- Provide appropriate food storage facilities and systems (do not leave a trace, do not liter).
- Provide appropriate garbage storage and disposal facilities and systems.
- Respect and obey dangerous wildlife signage.
- Report bear and cougar sightings.
- Watch animals in an area for signs of habituation and report problem wildlife.

9.32.3 Responsibilities

- Abide by applicable regulations.

- Follow approval conditions.
- Pay attention to signage.
- Follow industry practices.
- Act in a manner that ensures the protection of both workers and wildlife.

9.32.4 Training

As deemed appropriate, training should be provided to train workers on how to work safely around wildlife and what to do in case of an encounter. As a minimum, encounters should be reported using the hazard alert/near miss and/or incident reporting procedure. Several training courses are available and/or the company may evaluate inviting local Fish and Wildlife Officers to present at a safety meeting.

9.32.5 Bears

There are two types of bears in Alberta: black bears and grizzly bears.

Black bears are thickset, generally with a black coat and lighter muzzle, with small eyes and a tapered Roman nose, ears are rounded and bigger than those of a grizzly. Although mainly vegetarian, feeding on berries, fruit, and nuts), black bears will eat almost anything, including insects, fish, and sometimes small mammals or young ungulates. Bears drink often and are often found at sources of fresh water throughout the year. Black bears have short claws that are not retractable. Black bears are quick runners (up to 55km/hour) and excellent climbers. In the wilderness, black bears are active from dawn to dusk, closer to human settlements, bears are often nocturnal to avoid contact. Black bears mate from June to July, and search for a den in the fall (stumps, holes, culverts, pipes, etc.). Females line their den with leaves, grass and ferns, males do not. Black bears do not truly hibernate, their heart rate drops, but they may wake in the middle of the winter and wander about in mild weather. Cubs are usually born in the spring. Black bears are solidary, but the bond between mother and cubs is extremely strong. Mothers are very protective of cubs.

Grizzly bears look distinctly different from black bears. They have a large head, small eyes, and a nose that turns upward so that it shows a bit of a dip between brow and nose. Grizzlies have smaller ears than black bears; have a hump of muscle over their shoulders; and their coat is lighter on the head and shoulders with a dark body and darker feet and legs. Grizzly bears have long front claws (10+ cm). This means grizzly and black bear tracks are very different. The claws leave marks much further from the toe pads, when compared with the short claws of a black bear. Although classified as carnivores, 80-90 percent of grizzly bear diet is vegetation, especially berries. Grizzlies do prey on mammals using their excellent sense of smell. Grizzly bears are good swimmers and fast runners, and some can climb trees. Mating occurs in occurs in May to June and females den first around November and males wait until December. Two cubs are born in January or February, and emerge in May or May with the mother. Grizzly bears are extremely protective mothers. Like black bears, grizzly bears are not true hibernators and may be active throughout mild winters.

If a bear is encountered in any situation: do not feed the bear; and do not approach the bear or entice it to come closer.

There are four situations to be aware of when a worker comes upon a bear: the bear is unaware; the bear is aware; the bear is defensive; and the bear is predatory.

If a worker comes upon a bear (and the bear is unaware):

- Ready bear spray if available;
- Discreetly retreat;
- Double back;
- Keep eyes on bear (back away);
- Give a wide berth;
- Chose route with no other bears;
- Make presence known once 300m away (talk loudly, sing, etc.);
- Keep moving.

If a worker comes upon a bear (and the bear is aware):

- Ready bear spray if available;
- Stop, stay calm, assess the situation;
- Determine the distance from the bear;
- Do not turn around or run;
- Use a soft, low voice;
- Avoid rapid movements;
- Appear non-threatening;
- Keep eyes on bear without direct eye contact;
- Assess surroundings;
- Leave escape route for bear;
- Determine what the bear is doing (Food nearby? Young nearby?);
- If the bear bluff charges – stand your ground.

If a bear shows signs of stress, including: yawning, salivating, huffing, hair up on neck, bluff charging, stomping the ground and swatting trees (the bear is preparing for a defensive attack):

- Ready bear spray if available;
- Recognize the stress signs;
- Do not shout or escalate the situation;
- Attack will occur quickly and end when the bear sees the threat as gone;
- Do not move until the bear leaves;
- If the attack escalates, fight back.

If a bear shows signs of a predatory behavior, it may be preparing a predatory attack. Predatory behavior is characterized by stalking the worker, watching the worker intently and approaching the worker with no sign of fear or stress (the bear is preparing for a predatory attack):

- Ready bear spray if available;
- Do not be submissive;
- Face the bear;
- Act aggressively;
- Do not run;
- Scan for cover and move there;
- Remove pack and use as distraction;
- Prepare and use bear spray;
- Appear large;
- Raise arms and stomp feet;

- Stand on something;
- Use rapid arm/leg movements;
- Fight back – do not play dead;
- Attack eyes, nose and face of the bear.

9.32.6 Cougars

Cougars, also known as mountain lions, are large predatory felines. They have short, tan coats and a long, black-tipped tail. There is a significant variance in size and weight: males are heavier than females, and some individuals can reach two meters in length. Cougars are solitary and territorial and generally travel alone, unless with dependent young. Sub-adults may also remain with parents if they have not yet found their own territory. Male cougars have large home ranges that do not overlap with the ranges of other males. Females' ranges may overlap with each other. Cougars do not have a specific breeding season and instead breed any time throughout the year. Females using produce one to six kittens and remain with the mother for 12-18 months. Cougars are accomplished hunters and hunt at night (prey includes: mule deer, whitetail deer, elk, moose calves and smaller mammals). Similar to grizzlies, cougars bury prey with leaves or snow and return in a few days to continue to feed on the same buried carcass. Cougars are very elusive and hunt by sight or hearing, not scent. Cougars stalk prey until very close, and then attack in a final charge. Cougars kill prey by suffocation: they bite the prey's throat to crush the windpipe.

If working in cougar territory it is important to be aware and pay attention as follows: work in groups when possible; make noise (do not surprise a cougar); watch for tracks (similar to a large dog's but without claw marks – cougar claws are retractable); watch for buried carcasses.

Usually, cougars avoid humans and cougar attacks are rare, but can happen. If approached by a cougar:

- Never approach a cougar;
- Never feed the cougar;

- Prepare bear spray;
- Stay calm;
- Speak in a loud, commanding voice;
- Do not run;
- Do not turn your back;
- Back away very slowly, facing the cougar;
- Appear larger;
- Do not climb a tree;
- Do not take your eyes off the cougar;
- Make direct eye contact;
- Act aggressively;
- Stomp feet, wave arms; throw rocks/sticks;
- Find a weapon (stick, rock, knife).

If attacked by a cougar:

- Do not play dead;
- Fight for your life;
- Use bear spray;
- Use weapons;
- Protect throat and back of neck.

9.32.7 Hanta Virus

Hantavirus is a virus that is found in the urine, saliva, and feces of infected deer mice and some other wild rodents. People can become infected with Hantavirus in several ways:

- Inhalation of droplets of saliva or urine or dust from feces of infected wild rodents;
- Contact of contaminated material with broken skin; and
- Ingestion of contaminated food or water.

Hantavirus infection causes a rare but extremely serious lung disease called Hantavirus pulmonary syndrome. Approximately 40% of people who acquire Hantavirus pulmonary syndrome will die. Symptoms appear within 1 – 5 weeks after exposure. Early symptoms are similar to the flu, including fever, chills, muscle aches, headaches, nausea, vomiting, and shortness of breath. The disease progresses rapidly, leading to low blood pressure and fluid filling the lungs. Severe respiratory failure resulting in death can occur within just a few days after the onset of early symptoms. There is no vaccine to prevent Hantavirus infection, and there are no specific treatments or cures for Hantavirus infection. Early diagnosis and

supportive care in an intensive care unit are crucial to help prevent serious complications or death.

Hantavirus infection of people in Canada and the United States has been associated with certain activities including:

- Sweeping out barns, ranch buildings, and sawmills;
- Planting or harvesting field crops and handling grain contaminated with mouse droppings and urine;
- Trapping and studying mice;
- Living in dwellings with large indoor rodent populations or occupying previously vacant dwellings; and
- Disturbing rodent-infested areas while hiking or camping.

Workers might be exposed to rodents or contaminated material as part of their normal work duties. Employers are required to comply with relevant occupational health and safety regulations in their jurisdiction. Typically, employers are required to implement an exposure control plan to eliminate or reduce the risk of Hantavirus infection among employees. Exposure control plans should focus on reducing the presence of mice, reducing inhalation of potentially contaminated dust, and use of appropriate disinfectants and disposal methods.

Presence of mice can be reduced by:

- Storing food, water, and garbage in heavy plastic or metal containers with tight-fitting lids;
- Sealing holes in structures where mice may enter;
- Cutting back thick brush and keeping grass short;
- Keeping woodpiles away from buildings; and
- Setting traps when necessary and disposing of dead rodents in a sealed plastic bag.

Inhalation of potentially contaminated dust can be reduced by:

- Treating all mice and droppings as being potentially infected;
- Wearing disposable protective clothing and gloves, rubber boots, and a disposable N95 respirator for cleaning areas without heavy accumulation of droppings;
- Using powered air-purifying or air-supplied respirators with P100 filters and eye or face protection for cleaning rodent-contaminated areas with heavy accumulations of droppings.

Appropriate disinfectants and cleaning procedures include:

- Soaking dead mice, mice nests, and droppings in a 1:10 solution of household bleach (sodium hypochlorite);
- Disposal of contaminated material in sealed plastic bags;
- Wearing rubber or plastic gloves (neoprene, nitrile, or latex-free) when

cleaning up signs of rodents or handling dead rodents - gloves should be cleaned with warm soapy water before being removed, and hands should be washed with warm soapy water after gloves have been removed;

- Disinfect all reusable respirator surfaces, gloves, rubber boots, and goggles by wiping with bleach solution;
- Dispose of protective clothing, gloves, and respirators in sealed plastic bags.

9.32.8 Lyme Disease (Ticks)

Lyme disease is caused by bacteria called Borrelia burgdorferi. This bacterium is carried by certain types of ticks including the deer tick (Ixodes scapularis) and the Western blacklegged tick (Ixodes pacificus). Ticks usually live in woods or grasslands, attaching themselves to the skin of people or animals that pass by. People and animals can contract Lyme disease if they are bitten by a tick carrying the bacteria. Removing the tick within 24 - 36 hours usually prevents infection. Tick bites are usually painless and most people do not know they have been bitten. Before feeding, ticks look like small brown scabs or freckles; after feeding, ticks can be as big as a raisin or small grape. Tick bites most commonly occur from May to September in North America.

Symptoms of Lyme disease vary greatly from person to person. Common early symptoms include fatigue, fever, chills, headache, spasms or weakness, numbness or tingling, and swollen lymph nodes. One of the typical symptoms of Lyme disease is an expanding skin rash, sometimes called a “bull’s eye” rash because it may have rings spreading from the site of the tick bite. The rash usually appears within 7 – 14 days after infection and can last up to 8 weeks. However, it is important to realize that Lyme disease may cause skin rashes without a “bull’s eye” appearance and skin rashes do not occur in every case. More serious symptoms of Lyme disease include severe headaches and neck stiffness, cognitive dysfunction (brain fog) or dizziness, nervous system disorders (such as Bell's palsy involving loss of muscle tone or drooping of the face), arthritis, abnormal heartbeat or heart palpitations, and extreme fatigue. If untreated, the condition may progress to late disseminated Lyme disease involving recurring arthritis, numbness or paralysis, and other neurological problems. Deaths from Lyme disease are rare but may occur.

Lyme disease can be difficult to recognize and may be confused with other diseases. It is important that people consult with their doctor if they have been bitten by a tick or if they believe that Lyme disease is possible. Lyme disease can be diagnosed through blood tests for antibodies to the bacteria. However, “false negative” test results can occur if the level of antibodies is low. In the early stages, Lyme disease can be treated effectively with antibiotics. Later stages of the disease with more serious symptoms can be more difficult to treat and symptoms may persist.

Certain occupations and activities place people at higher risk for contact with ticks:

- Forestry, farming, construction, landscaping, grounds keepers, park or wildlife management;
- Veterinarians and other people who have contact with animals that may carry ticks (including wildlife and domestic animals like dogs, cats, goats, cows, horses);
- People who work outdoors, especially in grassy or wooded areas;
- People who spend a lot of time outdoors (hiking, camping, birding, golfing, hunting, fishing).

Workers might be exposed to ticks as part of their normal work duties. Employers are required to comply with relevant occupational health and safety regulations in their jurisdiction. Employers should implement an exposure control plan to eliminate or reduce the risk of contact with ticks among employees. Protective measures include:

- Consulting with local public health offices to find out if there are ticks in your area (especially Ixodes ticks);
- Wearing closed-toed shoes, long sleeve shirts that fit tightly around the wrist, and long-legged pants tucked into socks or boots;
- Using insect repellents containing DEET or Icaridin to repel ticks (apply to both clothes and skin);
- Checking for ticks on and under clothing including armpits, in and around hair, navel, groin, and behind the ears and knees (also check children and pets);
- Washing clothes promptly and using a dryer with heat to help kill remaining ticks;
- Showering or bathing within two hours of being outdoors to wash away loose ticks;
- Carefully removing ticks found attached to the skin. Use fine-pointed (needle-nosed) tweezers to grasp head and mouthparts of the tick as close to the skin as possible. Pull slowly to remove the whole tick. If the mouthparts of the tick break off or do not come out, try to remove them with tweezers. If unable to remove them easily, leave alone and let the skin heal. Wash affected area with soap/water or disinfect with alcohol hand sanitizer. Keep the tick for testing by placing it in a small sealed container or double zip lock bags. Write the date on the container or bag.
- Know the symptoms of Lyme disease. Contact a doctor immediately if you have an illness that resembles Lyme disease. If you saved the tick, bring it to your medical appointment as it may help the doctor.

9.33 Working Alone

9.33.1 Introduction

To work alone means to work alone at a work site in circumstances where assistance is not readily available in the event of an injury, illness or emergency. Readily available means to maintain visual contact between two or more workers.

9.33.2 General Considerations

When a worker is required to work alone, Pieridae is responsible to:

- Conduct a hazard assessment (with the worker) to identify existing or potential hazards arising from the conditions and circumstances of the worker's work and take steps to eliminate or control the hazards. A hazard assessment is triggered when visual contact cannot be maintained. Momentary loss of visual contact (i.e. worker passes behind a building, etc.) does not trigger the need for an assessment.
- Establish an effective means of communication (via radio, telephone, electronic communication devices) between the worker and persons capable of responding to the worker's needs. If an effective means of communication is not readily available at the work site, the worker must be visited at intervals deemed appropriate to the nature of the hazard.
- A hazard assessment and means of communication must be in writing and be communicated to all affected workers. The assessments must be kept on file and must be provided to Occupational Health and Safety Officers in the event of an inspection. Refer to Section 6.1.7 Job Hazard Analysis and Site Specific Procedure Development.
- Safe work permits can be used for contractors that will be working alone. A communication protocol can be listed in the section entitled additional comment section.

When conducting a hazard assessment, consider the following:

- Workers experience;
- Past incidents;
- Inspect the work area;
- Evaluate the factors that make the risk of violence more likely (i.e. poor lighting, lack of telephone communication, unsecured access, etc.); and
- Evaluate the factors that make the risk of injury more likely (i.e. high hazard work, isolation from medical aid, the effectiveness of existing safety measures such as standard operating procedures, proper training, etc.).

Hazard assessments are only required for each different set of working conditions and only need to be completed once for each set of working conditions. For example, when checking wells, a separate hazard assessment does not need to be completed for each well or each operator checking the wells, an assessment just needs to be completed for the hazards expected while checking wells in general. If conditions of the work change, then the hazard assessment must be updated.

9.33.3 Field Production Operations Standardization

Each area shall develop a working alone procedure that as a minimum includes regular check in, missing worker protocol (call down list and search and rescue).

9.33.4 Travel and Journey Management

Each provincial office shall develop a travel and journey management procedure for remote, isolated travel. Travel plans should include:

- The worker who will be travelling will advise a direct supervisor, or an immediate colleague, of travel plans via email.
- Travel information (itinerary).
- Contact information (at destination and spouse/family member information).
- Communication plan (check in schedule and method i.e. text, email, phone call etc.). As a minimum: departure, arrival at destination, and return home.
- Work scope while at destination (scope of work, description of site, required PPE if applicable, required training certifications to be able to access field work sites as may be required or confirmation of visitor status).

All workers are responsible to ensure that they are fit for work, achieve itinerary, follow agreed upon check in schedule.

In the event of a missing worker, as reported by spouse/family member, destination contact or supervisor/colleague, immediately activate the corporate ERP at alert level. Begin investigations by trying to establish contact with the worker and then retracing last known steps (e.g. flights, destination contact, spouse/family member, hotel etc.) Report to authorities as deemed appropriate.

9.34 Working at Heights

9.34.1 Introduction

A fall protection system is required in work areas where a worker may fall more than 3 metres (10 feet), or a vertical distance of less than these heights if there is an unusual risk of injury by falling into or onto a hazardous substance or object.

This procedure will provide information on:

- Fall protection plan
- Ladders
- Scaffolds
- PPE (Refer to Section 5.9 Fall Protection Equipment).

9.34.2 Fall Protection Plan

- If a worker at the work site may fall 3 meters or more and the worker is not protected by a guardrail, then specific Alberta OHS regulations must be followed and a fall protection plan must be developed.

- If the work site supervisor identifies the need for fall protection either through the safe work permitting procedure or job hazard analysis, a site specific procedure can be developed that must outline the site specific fall protection plan. Training needs must also be addressed in the fall protection plan.

9.34.3 Ladders

When working on a ladder at a height of 3 metres (10 feet) or more, personnel must be protected from falling; this protection is likely to be a lanyard and harness connected to an anchor point. An exemption from this requirement can be considered if the following conditions are met.

- The ladder is only being used for ascent/descent and not as a working platform or the work is light duty or of short duration;
- the worker's center of balance can be maintained in the center of the ladder at all times; and
- the worker can maintain a three (3) point contact whenever an arm is extended beyond the side rail.

Portable Ladders

- Portable ladders must be visually inspected for damage before use. Any identified damage must be repaired prior to use or the ladder tagged and removed from service.
- Ladders shall be placed on a level, stable surface.
- Use the 4 to 1 rule with straight ladders. This requires that the ladder be placed 0.3 metres (1 foot) away from the base for every 1.2 metres (4 feet) in height to the place where the top of the ladder rests.
- When used for access or egress, the side rails of an extension ladder must extend a minimum of 1 metre (3.3 feet) above the platform or landing.
- Portable extension ladders must be equipped with locks that securely hold the ladder in the extended position.
- When working in close proximity to electrical equipment, only non-conducting ladders will be used (e.g., fiberglass).

Fixed Ladders

- All fixed ladders must be constructed to meet regulatory requirements.
- All fixed ladders must be inspected regularly.
- Ladders over 3 metres (10 feet) must be equipped with a fall restraint system or ladder cage.

Scaffolds

- Personnel are responsible for working only on scaffolds that have been inspected and found acceptable and are indicated as such by the appropriate tags and permits.
- Scaffolds must be installed in accordance with manufacturer's specifications in compliance with regulatory requirements. Only qualified personnel are permitted to erect, maintain, and dismantle basic frame scaffolds.
- All scaffolds must be inspected prior to use. If scaffolds are set up and required to be used longer than one day or shift, a process must be established for routine inspections and maintenance by qualified or competent persons.
- Scaffolds must be constructed in accordance with applicable legislated regulations and be erected by competent workers.
- Vertical supports must be plumb and must rest on a firm surface.
- Working surfaces must be horizontal and secured against movement.
- Guardrails are required for all working surfaces above 3 metres.
- Rolling scaffolds must be used on smooth, level surfaces and must not be ridden when moved.
- The built-in scaffold ladder is the only accepted means of access and egress.

9.35 Violence & Harassment Prevention

9.35.1 Introduction

Pieridae expects everyone at the workplace to act towards others in a respectful and professional manner. Pieridae is committed to conducting its operations with a culture of respect in all its work activities and relationships with employees, contractors, and anyone who has a relationship with our company. Workplace violence and harassment is unacceptable and will not be tolerated.

Violence and harassment can take place at any work site and may range from disrespectful remarks to physical aggression. Addressing issues early can prevent acts of bullying and harassment from progressing to acts of physical violence. Workplace violence and harassment is unacceptable and will not be tolerated. This procedure constitutes Pieridae's harassment and violence prevention plan. Pieridae is committed to eliminating the hazard of harassment and violence, will investigate and follow up on reported incidents of workplace violence, and will not disclose the circumstances related to an incident of harassment or the names of parties involved (including the complainant, the person alleged to have committed the harassment, and any witnesses) except where necessary: to investigate the incident and to take corrective action, inform the parties involved in the incident of the results of the investigation and corrective action taken, or as required by law.

This section will:

- Outline the violence and harassment policy;
- Provide instruction on how to recognize workplace violence and harassment;
- Outline prevention actions a worker can take;
- Outline appropriate responses to workplace violence and harassment; and
- Outline procedures for reporting, investigating and documenting incidents of workplace violence and harassment.

9.35.2 Recognizing Workplace Violence & Harassment

To manage the issue of workplace violence, Pieridae will determine the nature and extent of the problem through consideration for: the workers that are hired; the sources of violence and work processes and the physical environment. The job hazard assessment (JHA) outlined in Section 6.1.6 Job Hazard Analysis and Site Specific Procedure Development can be used as a tool to identify areas where violence is a hazard.

The AB OHS definition workplace harassment is any single incident or repeated incidents of objectionable or unwelcome conduct, comment, bullying or action by a person that the person knows or ought reasonably to know will or would cause offence or humiliation to a worker, or adversely affects the worker's health and safety and includes: conduct, comments, bullying or actions because of race, religious beliefs, color, physical disability, mental disability, age, ancestry, place of origin marital status, source of income, family status, gender, gender identify, gender expression and sexual solicitation or advance, but excludes any reasonable conduct of an employer or supervisor related to the normal management of workers or a work site. The AB OHS definition of violence is the threatened, attempted or actual conduct of a person that causes or is likely to cause physical or psychological injury or harm and includes domestic or sexual violence. Violence at the workplace could put worker at risk of physical or psychological harm. Additionally, when an employer is aware that a worker is or is likely to be exposed to domestic violence at a worksite, the employer must take reasonable precautions to protect the worker and any other persons at the work site likely to be affected. Domestic violence becomes a workplace hazard, and is no longer limited to a personal issue, when it occurs or spills over into the workplace.

Workplace harassment may in fact be unintended; the test is whether a reasonable person knows or ought to have known that the behavior would be considered unwelcome or offensive by the recipient. Acts of violence and harassment may occur as a single event or may involve a continuing series of incidents and may occur at the workplace or at off-site business-related functions.

Workplace harassment does not include: reasonable actions taken by an employer or supervisor while managing and directing workers. Reasonable actions

considered to be part of a manger's or supervisor's work functions include: changing work assignments, scheduling, assessing and evaluating work performance, inspecting workplaces, implementing health and safety measures, and taking disciplinary action such as dismissing, suspending, demoting, or reprimanding with just cause. Done reasonably and fairly, these actions should not be considered to be workplace harassment.

9.35.3 Actions Workers Can Take - Prevention

If a worker is being bullied, discriminated against, victimized or subjected to any form of harassment:

DO

- Firmly tell the person that his or her behavior is not acceptable and ask them to stop. If necessary, ask a supervisor be with you when you approach the person.
- Keep a factual journal or diary of daily events. Record: the date, time and what happened in as much detail as possible; the names of witnesses; the outcome of the event.
- Remember, it is not just the character of the incidents, but the number, frequency, and especially the pattern that can reveal the bullying or harassment.
- Keep copies of any letters, memos, e-mails, etc., received from the person.
- Report the harassment to your supervisor, or a delegated manager. If your concerns are minimized, proceed to the next level of management.

DO NOT

- Do not retaliate. You may end up looking like the perpetrator and will most certainly cause confusion for those responsible for evaluating and responding to the situation.

9.35.4 Response to Workplace Violence & Harassment (Worker Support)

Any person who has been subjected to violence has the right to access assistance in communicating objections and, if warranted, in pursuing the complaint more formally. As a minimum, assistance may be provided by Human Resources personnel.

Victims of workplace violence or other workers who may have been exposed to a violent incident require emotional support and reassurance.

Refer to Section 9.11 Fit for Work - Mental Health in the Workplace.

9.35.5 Reporting and Investigating Workplace Violence & Harassment

If an incidence of workplace violence or harassment occurs it should be reported to the work site supervisor. The incident report form can be used to document workplace violence. Refer to Appendix 1, Form 11a – Incident Report.

The details of the incident including the date and time, nature of violence or harassment and names of persons who may have witnessed the violence or harassment should be recorded. A copy of the incident report should be sent to the Human Resources department. It is the responsibility of all persons involved in the processing of a compliant to ensure there are no recriminations to the complainant. Details concerning the disposition of a substantiated complaint of abuse/violence should include, as appropriate, the range of disciplinary measures. Refer to Section 3.5 Enforcement.

Reports of workplace violence or harassment will be held in strict confidentiality. It is the responsibility of any individual (work site supervisor or human resources personnel) who becomes aware of an incident of violence or harassment not to disclose the details of an incident to any third party without prior consultation of the victim.

An incident involving workplace violence generally constitutes an “accident that has the potential of causing serious injury to a worker” and as a result it must be investigated and retained on file for a period of two years. Any person who has been subjected to violence has the right to access assistance in communicating objections and, if warranted, in pursuing the complaint more formally. As a minimum, assistance may be provided by Human Resources personnel.

Section 10.0

Table of Contents

10.0 ENVIRONMENTAL OPERATING PROCEDURES

10.1 Considerations for Environmental Protection

10.1.1 Introduction

The operating procedures contained in this section are intended as a guide in conducting operations with consideration for environmental protection and are based on industry best practice. The procedures are partially based on regulatory requirements but are not intended to be used in substitution to regulations, nor are they intended to be an exhaustive review or interpretation of applicable legislation.

Environmental legislation is designed to protect the environment. All employees and contractors at Pieridae work sites must comply with applicable regulatory requirements. These requirements include acts, regulations, policies, practices and procedures that are administered by government agencies.

Refer to applicable provincial environmental legislation.

10.1.2 General Rules for Environmental Protection

- Plan operations from “cradle to grave”.
- Report unsafe acts that could result in harm to the environment.
- Address the issues if they are known, do not turn a blind eye.
- Conserve topsoil.
- Protect water resources.
- Control emissions.
- Prepare emergency response plans.
- Manage waste.
- Do not litter.
- Conduct HSE inspections.
- Regulatory inspections may be conducted at any time and participation and cooperation is required.
- If an incident occurs follow proper procedures.
- Practice good housekeeping at all times.
- Report HSE issues internally and externally as required.
- Maintain records as required.

10.1.3 Pre-Surveying

Consult this section prior to surveying a location to obtain understanding of well center requirement and access road flexibility, both of which may have significant impacts on the construction and reclamation methods and associated costs.

- Identify target information (coordinates).
- Identify minimal spacing requirements.
- Understand the drilling program.
- Identify land ownership and any special interest parties.
- Identify other potential stakeholders.
- Identify special land uses and/or wildlife and/or wildlife habitats and operational timing constraints.
- Compare risk versus cost.
- Identify timing requirements and compare with timing constraints to determine feasibility.
- Identify operational needs during production phase.
- Maintain records.

10.1.4 Surveying

Surveying the proposed well, pipeline or facility and access road provides information both for the construction phase and for the eventual reclamation of the proposed development.

- Ensure appropriate personnel are onsite (i.e. drilling supervisor, facility or pipeline inspector etc. depending on the project).
- Understand the size (width and length) requirements and regulatory limits.
- Conduct a pre-disturbance assessment (if required or deemed appropriate).
- Initiate an environmental file (consider the reclamation criteria information that will be required when the site is abandoned and reclaimed).
- Conduct water well testing if required.
- Ensure survey drawings have sufficient information.
- Maintain records.

10.1.5 Construction and Clean Up

Proper construction will have positive impacts throughout all phases of operations including reclamation.

- Review the survey plan and understand the potential safety impacts and concerns before starting construction.
- Obtain and have approvals onsite.
- Conduct notifications as required.
- Conduct a pre-job meeting with the contractor and review the construction techniques.
- Document activities.
- Salvage and conserve soil.
- Clean up drilling wastes as per provincial regulations.

- Work with production operations to build adequately sized and properly spaced work areas.
- Recontour.
- Revegetate.
- Construct access roads with consideration for approval conditions and operational requirements.
- Maintain records.

10.1.6 Drilling Operations

Considerable environmental costs can be associated with drilling wastes, including disposal, negative impacts on soil, surface and groundwater contamination and the ultimate reclamation of the site.

- Plan the rig move in fair conditions if possible (i.e. dry or frozen ground conditions).
- Ensure adequate working space is available and authorized for use.
- Manage wastes properly.
- Minimize wastes wherever possible.
- Protect and minimize water usage whenever possible.
- Stay on right-of-way (i.e. do not go offsite).
- Clean up spills.
- Consider post-drilling impacts (i.e. cattle, etc.).
- Document activities.
- Clean up drilling wastes as per provincial regulations.
- Communicate with production operations.
- Maintain records.

10.1.7 Well Completions and Workovers

Considerable environmental costs can be associated with service rig wastes due to impact on soils, surface and groundwater.

- Plan the rig move in fair conditions if possible (i.e. dry or frozen ground conditions).
- Ensure adequate working space is available and authorized for use.
- Do not use salvaged soils for constructing berms or roads.
- Stay on right-of-way (i.e. do not go offsite).
- Minimize wastes.
- Prevent leaks, drips and spills by using containment trays or immediately cleaning up contamination.
- Manage wastes properly.

- Maintain records.

10.1.8 Operations

Operational activities can have a large impact on environmental considerations as operational activities generally span a number of years.

- To the extent possible, be involved with the construction and clean up phase to ensure adequate access and site area for operations.
- Ensure approvals are in place prior to beginning operations.
- Follow approval conditions.
- Conduct reporting as required by approval conditions.
- Complete annual reporting requirements such as dehydrator inventory (benzene emissions) and NPRI.
- Practice good housekeeping at all times.
- Understand the emergency response plans in place (e.g. corporate ERP, specific ERP for sour operations, federal ERAP if offering sale or transport of NGLs, federal E2 plan if storing large quantities of NGLs).
- Conduct inspections as required.
- Clean up drips, leaks and spills.
- Maintain equipment.
- Collect and document data as required (e.g. ambient air monitoring boxes, monthly visual AST/UST inspections, fugitive emissions testing).
- Report incidents.
- Participate in inspections whether internal, external or regulatory.
- Report spills.
- Be a good neighbor.
- Keep abreast of changing regulations.
- Participate in training.
- Manage waste appropriately.
- Maintain vegetative cover and control weeds.
- Prevent erosion.
- Control surface water releases.
- Conduct groundwater sampling if required by approvals.
- Communicate and share knowledge.
- Maintain records.

10.1.9 Abandonment, Remediation and Reclamation

Careful planning and data review should be completed prior to initiating abandonment procedures. It is very important to understand the provincial

reclamation and remediation guidelines. Maintain good relations with the landowner throughout life of the project.

- Manage wastes appropriately.
- Reclaim as per provincial standards.
- Achieve equivalent land use capability.

10.2 Surface Water Runoff/Discharge

10.2.1 Introduction

The purpose of this procedure is to provide general guidelines for managing surface water runoff and to specify criteria for releasing collected water off site. Pieridae will manage surface water runoff in a manner that will minimize the impacts to the wellsite and surrounding property.

10.2.2 Management of Surface Water Runoff

Surface water will be managed based on site topography, soil permeability, rainfall statistics, proximity to nearby waterbodies, potential sources of contamination and adjacent landowner concerns. Typically, runoff will be controlled using ditching or berms so that runoff is collected at points where there are facilities or features in place for the containment of spills or processed liquids. Additionally, good housekeeping practices including proper storage and handling of potential contaminants will be maintained and spills will be prevented. Spills will be immediately addressed and appropriately managed. Refer to Section 10.6 Spill Preparedness and Response.

Consultation with Alberta Environment is required in order to use collected surface water for a facility process as it may be necessary to obtain a diversion license.

Facilities that are located in close proximity to surface water bodies may need to implement a monitoring program to ensure that surrounding water is not adversely impacted by production operations.

10.2.3 Discharge of Surface Water Runoff

Provided that the water has not been contaminated, collected surface water runoff should be released back to the surrounding environment. Each release must be documented. Refer to Appendix 1, Form 21 – Surface Water Runoff Release.

Collected water must be tested and meet the following criteria prior to being released:

- Chloride content 500mg/L maximum (use test strips);
- pH 6.0-9.0 (use test strips or meter reading);
- No visible hydrocarbon sheen (roughly equates to less than 10mg/L);

- No other chemical contamination (i.e. good housekeeping/clean operating conditions such that collected water is not impacted by spills);
- Landowner or occupant consent is required for discharge on private lands (no approval required for discharge on crown land);
- Discharge water is not allowed to flow directly in to a watercourse; and
- Each release must be recorded (included pre-release data and the estimated release volume).

Contaminated water must not be released in to the environment. On sites where spills have occurred, the collected surface water should be tested by an accredited analytical laboratory for parameters that will demonstrate that the water was not affected. If water has been adversely impacted by a spill, it should be sent to an approved facility for disposal or, if possible, treated onsite and then released.

Alberta Environment approved facilities may be subject to additional conditions pertaining to the discharge of collected surface water and the relevant approval should be reviewed.

10.3 Waste Management

10.3.1 Introduction

The purpose of this procedure is to provide general guidelines to operations personnel regarding the proper storage, handling, transportation, treatment and disposal of upstream dangerous and non-dangerous oilfield wastes. Pieridae will conduct operations in a manner that minimizes waste production through reducing, recycling, reusing, or recovering products before they become wastes. The objectives of the waste management procedure are:

- Provide standard and basic level of training to operations personnel;
- Raise awareness of regulatory requirements;
- Protect the environment through proper waste management handling techniques; and
- Manage and reduce liability by using licensed/approved oilfield waste disposal facilities and proper waste disposal techniques.

Wastes are produced at all stages of oil and gas production from geophysical operations through drilling, operations and eventual abandonment and reclamation. An oilfield waste is defined as an unwanted substance or mixture of substances that results from the construction, operations or reclamation of a wellsite, oil, or gas battery, gas plant, crude oil terminal, compressor station, pipeline, gas gathering system, heavy oil site, soil sands site or related facility.

The primary reference document in Alberta is AER Directive 58 Oilfield Waste Management Requirements for the Upstream Petroleum Industry. However, Directive 55 provides guidance on storage requirements and Directive 50 provides

guidance with respect to drilling waste disposal and should be specifically referenced for drilling operations.

Further, federal Transportation of Dangerous Goods (TDG) act and regulations should be referenced as it controls all movement of dangerous goods within Canada. TDG is divided into 9 classifications and is used to define hazardous waste under the Alberta Environmental Enhancement and Protection Act and dangerous oilfield wastes (DOWs) under D58. TDG outlines the responsibilities of shippers, carriers and receivers; and covers documentation, labeling and placarding requirements. Oilfield waste has certain TDG exemptions, however AER waste manifesting guidelines apply. Refer to Section 6.7 Transportation of Dangerous Goods.

10.3.2 Waste Minimization

Waste minimization is an opportunity for continuous improvement. It is an ongoing process involving the 4Rs (reduce, reuse, recycle, and recover), and includes the full-cycle assessment of environmental effects and the associated economic and technical feasibility of the various management options.

- Reduce: generate less waste through efficient practices, promote optimum use of chemicals.
- Reuse: reuse materials (i.e. rags).
- Recycle: convert waste back into a usable material (i.e. used lube oil).
- Recover: extract materials or energy from a waste for other uses (i.e. waste to energy facilities).

10.3.3 Waste Characterization and Classification

It is often useful to begin the process by preparing a list of wastes generated at a facility or operating area. This will enable operations staff to understand the types of wastes that are generated at a specific site. For example, a facility may have the following types of wastes:

- Produced water;
- Used oil;
- Oily rags;
- Filters;
- Domestic garbage (i.e. office waste);
- Pigging waste; and
- Contaminated soil (i.e. drips and small spills).

As the waste generator, Pieridae is responsible to properly characterize each waste that it produces. Waste characterization is the assessment of the physical, chemical, and toxicological characteristics of a waste. The waste characterization is then used in assessing the appropriate handling, treatment, and disposal of that

waste. There are two primary reasons for characterization: to determine the dangers relating to transportation on public roads; and to determine the environmental consequences of the waste so that an appropriate disposal or management option is used.

Once an oilfield waste has been characterized, it can be classified into one of two classifications; dangerous oilfield waste (DOW) or non-dangerous oilfield waste (non-DOW). Wastes must be classified as either DOW or non-DOW.

Sufficient historical data exists for some waste streams whereby common acceptable treatment and disposal practices have been established. It is important to recognize that not all waste types are listed and testing may be required before determining appropriate treatment and disposal methods.

10.3.4 Waste Manifesting and Tracking

It is Pieridae's responsibility to track its waste from "cradle to grave". The work site supervisor that calls for waste disposal is responsible to ensure that a AER Directive 058 waste manifest is properly completed and sent with the waste shipment for the protection of the public (as per Transportation of Dangerous Goods regulations) and to ensure proper waste disposal and tracking. Form completion instructions are detailed on the back of the waste manifest form. The most recent AER waste codes are detailed in D047, Appendix 3. TDG information must also be added.

The waste manifest has three parts that must be filled out:

- Part A to be filled out by Pieridae as the generator of the waste. The AER Pieridae operator code, Pieridae Calgary address, surface location, and receiving site location, authorized person, authorized person contact number, and Pieridae 24 hour emergency number must clearly legible. (There are certain circumstances when the transporter will arrive onsite with manifests that have been pre-filled and, in these cases, the Pieridae work site supervisor should double-check the form before signing.)
- Part B to be filled out by the transporter/carrier.
- Part C to be filled out by the receiver.

Once the waste manifest is completed on site, the work site supervisor will retain the blue copy of waste manifest for file.

The trucking company will fill out the transporter/carrier section of the waste manifest. The transporter must carry the white, yellow and pink copy of the waste manifest with the waste shipment. If there is a serious discrepancy as a result of transporter error (i.e. a trucking spill), the transporter must notify Pieridae as soon as possible. If there are any discrepancies it must be recorded in the comments section.

The waste receiver will fill out the receiver portion of the waste manifest and return the pink copy to the transporter (once filled out by the receiver) and will retain the yellow copy (for receiver records). The white copy (original first page filled out by generator, transporter and receiver) will be sent back to Pieridae by the receiver (usually with an invoice for disposal fees). The waste receiver will add any comments about waste discrepancies.

The Calgary office will track waste manifests and information will be provided to the AER upon request (i.e. audit). The Calgary office can also add comments to the original manifest with respect to reconciliation/tracking (in the comments section).

10.4 Benzene Emissions

10.4.1 Introduction

Crude oil and natural gas condensate contain benzene although the concentration varies considerably depending on the geology and location of the well site. Drilling fluids may contain benzene and can also become contaminated with benzene when they are recirculated down well. Benzene and other hydrocarbons are reduced from stacks, flares, hydrocarbon storage facilities, glycol dehydrators and other operations that involve crude oil or fuels. In the upstream oil and gas sector, glycol dehydrators are the primary source of benzene emissions. Benzene is toxic and a carcinogen.

In Alberta, as per AER Directive 039: Revised Program to Reduce Benzene Emissions from Glycol Dehydrators, there is a requirement to: inventory glycol dehydrators and submit information to the AER annually; reduce emissions; and complete and maintain a DEOS (Dehydrator Engineering and Operations Sheet) at each dehydrator (that must be posted at the dehydrator for use by operations staff and inspection by the AER).

This procedure provides the basis for benzene emission management in Alberta and should be supplemented with a site specific procedure when deemed appropriate. This procedure will provide an overview of the following:

- Worker responsibilities and training requirements;
- Benzene characteristics;
- Benzene exposure limits;
- Glycol dehydrator emissions proximity to surface development (AER);
- Glycol dehydrator emissions limits (AER);
- Cumulative site emissions limits (AER);

- Operating procedures.

10.4.2 Responsibilities and Training

For each work site where benzene exposure is a hazard (e.g. sites with glycol dehydrators) the work site supervisor will communicate the hazards and follow this operating procedure and/or develop a site specific procedure.

10.4.3 Benzene Characteristics

- Benzene is classified as a toxic substance and is a carcinogen.
- Benzene is a clear, colorless liquid with a sweet odor. The odor threshold is around 60ppm but varies from 0.78-160ppm.
- Benzene is extremely flammable (flash point is -11 degrees Celsius).
- The flammable range of benzene is 1.2-7.8 percent.
- Pure vapor is heavier than air.
- The liquid is lighter than water and floats on top of water if mixed.

10.4.4 Benzene Exposure Limits

- The OEL of benzene is 0.5ppm.
- Workers may become exposed to benzene by inhalation or by direct contact with the skin. This may occur when changing filters and pumps and when handling rich glycol at dehydrators. Although readily absorbed after inhalation, benzene is not easily absorbed through skin contact. The absorption of benzene vapor through the skin is unlikely to be significant at concentrations below 25ppm.
- Short-term (acute) exposure to benzene at high concentrations can cause depression of the central nervous system, causing drowsiness, dizziness, headache, nausea, vomiting, sleepiness, fatigue, slurred speech, loss of balance and disorientation. These effects are not usual at concentrations below 25ppm, and are more common at 50-100ppm. As concentrations of benzene vapors in the air increase, the health effects become more severe (vertigo, confusion, loss of consciousness). Exposure to about 20,000ppm for 5-10 minutes can cause death.
- Chronic health effects (prolonged or repeated) contact with the skin causes redness, drying and cracking because benzene dissolves and removes the protective natural oils from the skin. The most important health effect of benzene is its impact on the blood system. Benzene can be metabolized in the liver and bone marrow and its metabolites can damage the bone marrow where new blood cells are produced. At high concentrations these metabolites can cause a serious condition where the number of red blood cells, white blood cells and clotting cells is reduced. In the initial stages, this effect is thought to be reversible, but with continued exposure it may progress to aplastic anemia or leukemia. Benzene can weaken the immune system by lowering the number of white blood cells that are produced. Studies of workers have shown that the damage to the blood system can occur with exposure to benzene at concentrations of 30-120ppm over a time period of three months to 17 years.

Exposure to benzene below workplace occupation exposure limits have not been show to produce damage to blood cells.

10.4.5 Benzene Emission Limits (AER)

- An annual dehydrator benzene inventory list must be submitted to the AER by May 1 each year. If it is identified that operations do not comply with emissions limits, it must be reported to the AER and immediate steps must be taken to bring operations into compliance (e.g. modify operations, such as glycol circulation rate, pump changes, shutdown).
- Dehydrator benzene emissions released to the atmosphere from still-column-vent or still-column control technology are based on the distance from the dehydrator emission control source to the nearest close-proximity development (nearest receptor). Calendar-year emission limits for all dehydrators as of January 1, 2018 are listed in the table below.

Benzene Emissions Requirements			
Section		**Distance in metres to the nearest close proximity development**	**Emission limit in tonnes in each calendar year**
A	No control or after control other than an appropriately designed flare, incinerator or reciprocating engine	≤ 100	0.0
		101-250	0.1
		251-750	0.5
		not within 750	1.0
B	After-control emission limit for an appropriately designed flare, incinerator or reciprocating engine	≤ 750	1.0
		not within 750	3.0

- An appropriately designed flare or incinerator must meet the performance requirements in Directive 060, Section 7 for sour gas > 10 mol/kmol H_2S to be eligible for the after-control emission limits stated above. An incinerator stack must be at least 9 m tall to be eligible for the emissions limits stated above. A reciprocating engine exhaust stack must be at least 6 m tall to be eligible for the emissions limits stated above. Where equipment does not meet the requirements for an appropriately designed flare, incinerator or reciprocating engine (e.g. stack height), the after-control emission limits cannot be applied.
- If more than one dehydrator is located at a site, Pieridae must ensure that the cumulative benzene emissions for all dehydrators on that one site do not exceed the highest individual dehydrator emission limit for that site.

- For dehydrators that are only operating for a part of a year (e.g. due to seasonal operation or when shut in for part of a year), Pieridae must ensure that the annual emission limit is prorated and is calculated based on the portion of the calendar year in which the dehydrator was operating. The mass (tonnes) of benzene that was released during the operating period is assessed against the calculated prorated emission limit.
- When evaluating dehydration requirements in order to achieve the lowest possible benzene emission levels the AER Decision Tree Process of the CAPP Best Management Practices for Control of Benzene Emissions from Glycol Dehydrators must be used and retained on file.

10.4.6 Cumulative Site Emissions for All Benzene Release Sources (AER)

- Cumulative benzene emissions from all sources (dehydrator emissions plus other sources, e.g. tanks, excluding emissions from appropriately designed flare, incinerator and reciprocating engine exhaust on the site), do not exceed the benzene emission limits noted below by January 1, 2021.
- Limits are based on the distance from the site boundary to the nearest close-proximity development and excludes appropriately designed flare, incinerator, and/or reciprocating engine exhaust emissions as defined above. The licensee can apply the least restrictive of the dehydrator or site benzene emissions limits for all sources where the distance from the nearest close-proximity development to the site boundary and dehydrator emission source are different distance resulting in two limits per 10.4.5 above and this section.
- Cumulative site emissions for all benzene release sources as of January 1, 2021 are:

	Distance in metres to the nearest close proximity development	**Emission limit in tonnes in each calendar year**
All sources of cumulative release, excluding appropriately designed flare, incinerator or reciprocating engine.	$\leq$ 100	0.0
	101-250	0.1
	251-750	0.5
	Not within 750	1.0

- An appropriately designed flare or incinerator must meet the performance requirements in Directive 060, Section 7 for sour gas > 10 mol/kmol H_2S. An incinerator stack must be at least 9 m tall to be excluded from the above cumulative site emissions limits. A reciprocating engine exhaust stack must be at least 6 m tall to be excluded from the above cumulative site emissions limits. Where equipment does not meet the requirements for an appropriately designed flare, incinerator or reciprocating engine (e.g. stack height), emissions from this equipment will be included.

10.4.7 Operating Procedures

If sources of benzene are identified (e.g. changing filters on dehydrators), then a definitive testing and assessment procedure should be completed. Testing should involve spot checking facilities with any level of benzene in the inlet stream. If

Draeger tube results are greater than 5ppm then industrial hygiene monitoring should occur (i.e. monitor both the STEL or short term exposure limit and long term or 8 hour occupational exposure limit). If the monitoring results exceed the occupational exposure limits then more detailed engineering and occupational hygiene assessment should be completed.

Exposure to benzene can be reduced using engineering controls, administrative controls and personal protective equipment. Exposures approaching regulated limits will require enhanced site specific procedures. As a minimum, proper ventilation and use of proper PPE is required. A site specific procedure should be developed in operating areas where benzene is identified as a hazard. Options to reduce risk include:

Engineering controls

- Optimize glycol circulation.
- Implement alternatives for hydrate control and dehydration, such as using flash tank separator, a line heater, or solid desiccant or molecular sieve plants.
- Ensure that equipment and barriers for preventing exposure are working and maintained according to specifications.
- If ventilation systems are used, they must be properly designed and not vent back into the work area. For example, benzene emissions from glycol dehydrators can be reduced by installing flash tank separators. Environmental standards also restrict the amount of benzene that can be discharged to the outside air.

Administrative Controls

- Verify that safe work practices are formalized, reviewed and updated.
- Ensure that employees are properly trained in safe work practices.
- Monitor air to ensure that the benzene concentration does not exceed the occupational exposure limit.

Personal Protective Equipment (PPE)

- Respiratory protective equipment is used to protect workers from inhaling airborne vapors. Refer to Section 5.10 Respiratory Protective Equipment.
- Close fitting goggles or full-face respirator masks should be worn to protect the eyes from irritation or splashes.
- Wear, wash and maintain chemical-resistant clothing (gloves, coveralls, boots) appropriate for conditions of use.
- Where skin contact with liquids containing benzene occurs, the area should be thoroughly washed immediately.

10.5 Vent Gas Limits and Fugitive Emissions Management (Alberta)

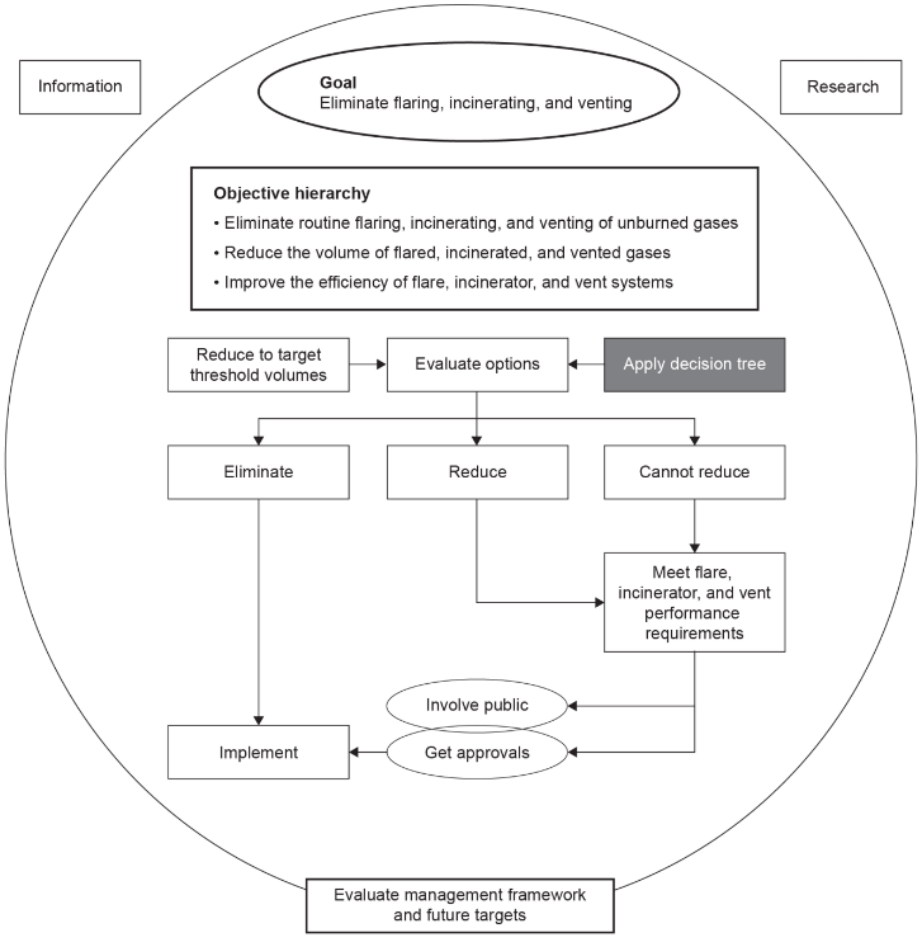
10.5.1 Introduction

Provincial requirements and regulatory approvals regarding vent gas emissions and fugitive emissions will be followed.

In Alberta, AER Directive 060: Upstream Petroleum Industry Flaring, Incinerating and Venting, outlines requirements. The directive sets out requirements for flaring, incinerating and venting in Alberta at all upstream petroleum industry wells and facilities. These requirements also apply to pipeline installations that convey gas (e.g. compressor stations, line heaters) licensed by the AER in accordance with the Pipeline Act. The requirements ensure that public safety concerns and environmental impacts are addressed before beginning to flare, incinerate, or vent. Requirements are aligned to ensure compliance with Alberta Ambient Air Quality Objectives and Guidelines. In accordance with the objective hierarchy, the following three options must be evaluated:

- Can flaring, incineration, and venting be eliminated?
- Can flaring, incineration and venting be reduced?
- Will flaring, incineration, and venting meet performance standards?

10.5.2 Hierarchy



Reference: AER D060, Figure 1 Solution gas flaring/venting management

framework (adapted from CASA)

10.5.3 Vent Gas Limits and Fugitive Emissions Survey Requirements

In Alberta, the AER has provided a summary of vent gas limits and fugitive emission survey requirements; “existing” means before January 1, 2022; “new” means on or after January 1, 2022. The table below summarizes the vent gas limits and fugitive emissions management requirements in D060, Section 8 and is provided for information only.

- Under the overall vent gas (OVG) limit, which includes all routine (continuous or intermittent venting on a regular basis as part of normal operations) and nonroutine (intermittent and infrequent venting that can be planned or unplanned) vent gas, are source-specific vent gas limits that must be followed while remaining in compliance with the overall vent gas limit.
- Defined vent gas (DVG) is vent gas emitted from routine venting, excluding vent gas from pneumatic devices, compressor seals, and glycol dehydrators.
- Fugitive emissions are the unintentional releases of hydrocarbons to the atmosphere.

Source	Category (effective date)	Requirement
All venting sources	**Overall vent gas limit** (January 1, 2020, with specified exemptions until 2023)	15.0 10^3 m^3/month/site or 9.0 10^3 kg of methane/month/site
Venting	**Defined vent gas limit for new sites** (January 1, 2022)	<3.0 10^3 m^3/month/site or <1.8 10^3 kg of methane/month/site
	Defined vent gas limit for existing sites	Subject to overall vent gas limit
	Vent gas limits for new and existing crude bitumen batteries (January 1, 2022)	Either • defined vent gas limit for each site, or • crude bitumen fleet average in each month of 3.0 $10^3 m^3$/facility ID
Pneumatic devices	**Vent gas limits for new pneumatic devices** (January 1, 2022)	Prevent or control vent gas from at least 90 per cent of the instruments installed in a calendar year Venting instruments: • Level controllers: Use a relay that has been designed to reduce or minimize transient or dynamic venting, or adjust the actuation frequency to ensure that the time between actuations is greater than 15 minutes • Pneumatic instruments other than level controllers: Manufacturer-specified steady-state vent gas rate of less than 0.17 m^3/hr Prevent or control vent gas from pneumatic pumps operating more than 750 hours/year
	Vent gas limits for existing pneumatic devices (January 1, 2023)	Level controllers: Prevent or control vent gas, use a relay that has been designed to reduce or minimize transient or dynamic venting, or adjust the actuation frequency to ensure that the time between actuations is greater than 15 minutes

Source	Category (effective date)	Requirement
		Pneumatic instruments other than level controllers: Prevent or control vent gas or ensure instruments have a manufacturer-specified steady-state vent gas rate of less than 0.17 m^3/hr
Compressors seals	**Vent gas limits for new reciprocating compressors** (January 1, 2022, for units with ≥4 throws) (January 1, 2023, for units with <4 throws)	Units with ≥4 throws: Control vent gas Units with <4 throws: Fleet vent rate of <0.83 m^3/hr/throw, with no compressor venting gas over 5.00 m^3/hr/throw
	Vent gas limits for existing reciprocating compressors (January 1, 2023)	Reciprocating-compressor-seal fleet: <0.83 m^3/hr/throw, with no compressor venting gas over 5.00 m^3/hr/throw
	Vent gas limits for new centrifugal compressors (January 1, 2022)	<3.40 m^3/hr/compressor
	Vent gas limits for existing centrifugal compressors (January 1, 2023)	<10.20 m^3/hr/compressor
Glycol dehydrators	**Vent gas limits for new glycol dehydrators** (January 1, 2022)	<68 kg of methane/day/glycol dehydrator
	Vent gas limits for existing glycol dehydrators (January 1, 2023)	Glycol dehydrator fleet: <136 kg of methane/day
Fugitive emissions	**Facility or equipment type:** Gas plants (<0.01 mol/kmol H_2S) Compressor stations (<0.01 mol/kmol H_2S) Controlled liquid hydrocarbon storage tanks Controlled produced water storage tanks	Triannual fugitive emissions surveys
	Gas plants (≥0.01 mol/kmol H_2S) Compressor stations (≥0.01 mol/kmol H_2S) Batteries and associated satellite facilities Custom treating facilities Terminals Injection/disposal facilities	Annual fugitive emissions surveys
	Well sites (January 1, 2020)	Annual screenings

10.5.4 Implementation

AER requirements for venting and fugitive emissions management must be followed (AER D060, Section 8 Venting and Fugitive Emissions Management Requirements).

Venting and/or fugitive emissions must not result in any H_2S odours outside of the

lease boundary. Gas containing more than 10 mol/kmol H_2S must not be vented to the atmosphere (excluding crude bitumen batteries). This includes off stock tanks, PSVs, and equipment blowdown systems. Sour PSVs must be tied into flare systems if the gas contains more than 10 mol/kmol H_2S or result in off-lease odours. At crude bitumen batteries, H_2S must not be vented to the atmosphere at a release rate of greater than 0.04^3/hr. Sour PSVs must be tied into flare systems if the total H_2S release rate is greater than $0.04m^3$/hr or results in off-lease H_2S odours.

- 10 mol/kilomole = 10,000,000 ppb, 10,000 ppm, 1 mole % (volume), 0.01 mole fraction (Refer to AER D056 H2S Conversion Calculator).

Venting and/or fugitive emissions must not result in any H_2S odours outside of the lease boundary. Venting and/or fugitive emissions must not result in any offensive hydrocarbon odours outside the lease boundary that, in the opinion of the AER, are unreasonable either because of the frequency, the proximity to surface improvements and surface developments, duration or strength.

Pressurized tank trucks or trucks with suitable and functional emission controls must be used when transporting sour fluids from upstream petroleum industry facilities.

The first step in mitigating fugitive emissions is sound engineering design of equipment and corresponding components including material selection and piping stress review. Manufacturer's installation procedures and operating limitations must be followed.

Efficient management of fugitive emissions is best achieved through the application of direct inspection and management techniques which focus inspections and correction efforts on areas most likely to offer significant cost-effective control opportunities. AER forms, such as the Fugitive Emissions Survey or Screening Record can be used to collect facility information. A program to detect and repair leaks must meet or exceed the Canadian Association of Petroleum Producers (CAPP) Best Management Practice for Fugitive Emissions Management.

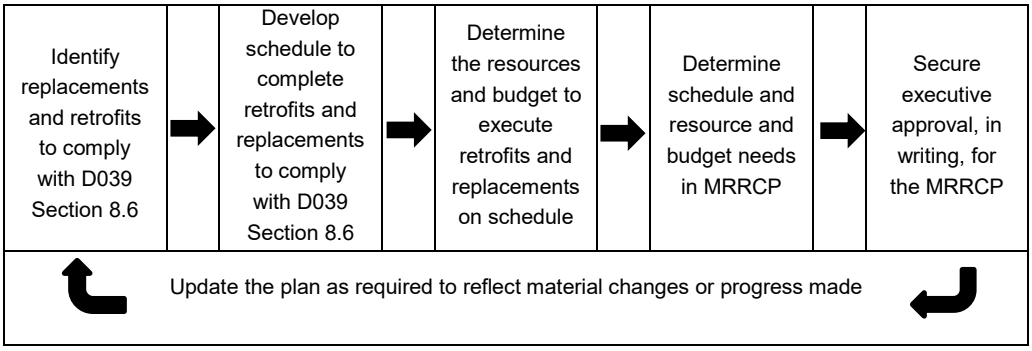
10.5.5 Methane Reduction Retrofit Compliance Plan

The equipment retrofit and replacement requirements in AER Directive 039, Section 8 involve advance planning and investment to ensure compliance on the date the requirements take effect. As a result, AER requires that a methane reduction retrofit compliance plan (MRRCP) be prepared, with the following components:

- The documented MRRCP must indicated how compliance with Directive 039, Section 8.6, Equipment-Specific Vent Gas Limits, will be achieved.

- The MRRCP must contain, at a minimum, the schedule to replace or retrofit existing equipment and the resources and budget allocated to ensure compliance with the requirements.
- The MRRCP must be updated annually until January 1, 2023, to reflect material changes or progress made over the year according to the process diagram below.
- An executive of the company must approve the MRRCP in writing, attesting that the MRRCP is designed to ensure compliance with the requirements.

Process for Developing and Implementing a Methane Reduction Retrofit Compliance Plan



10.5.6 Measurement and Reporting of Methane Emissions

Methane emissions may be quantified using continuous metering, periodic testing, or estimates based on accepted engineering practices. AER Directive 017 identifies when vent gas from a site must be quantified using continuous metering or periodic testing, as well as acceptable testing methods. AER Manual 015: Estimating Methane Emissions, provides guidance on how to estimate vent gas and fugitive emissions.

The annual methane emissions reporting period is the calendar year. The operator of record of a facility on December 31 is responsible for reporting over the entire reporting period, regardless of any changes in ownership during the reporting period.

Additional annual methane emission report requirements are set out in the corresponding vent gas limits and fugitive emissions management sections. Requirements are:

- The operator of record for a facility that was active in a reporting period must electronically submit an annual methane emissions report to the AER by June 1 of the following calendar year. The first reporting period is 2019, and the first annual methane emissions report must be submitted to the AER by June 1, 2020.
- Annual inventories must reflect equipment in place at the end of each reporting

period.

- For facilities that do not require a license (such as small booster compressors), the venting and equipment must be reported to the nearest upstream reporting well, battery, or pipeline facility.

10.5.7 Overall and Defined Vent Gas Limits

- Overall vent gas (OVG) is all routine and nonroutine vent gas and must be limited at a site to less than 15.0 10^3 m^3 of vent gas per month or 9.0 10^3 kg of methane per month.
- Vent gas from pneumatic devices, compressor seals, and glycol dehydrators are excluded from the OVG limit until January 1, 2023.
- Defined Vent Gas (DVG) is vent gas from routine venting, excluding vent gas from pneumatic devices, compressor seals, and glycol dehydrators. Equipment must be designed and operated for any site with first receipt or production on or after January 1, 2022, to limit the DVG emitted to less than 3.0 10^3 m^3 of vent gas per month per site or less than 1.8 10^3 kg of methane per month per site.
- The annual methane emissions report must include: the annual volume of DVG emitted (m^3) by facility ID, and the corresponding mass of methane emitted (kg) by facility ID.

10.5.8 Vent Gas Limits for Pneumatic Devices

The following requirements apply to gas-driven pneumatic devices, including instruments (e.g., controllers, switches, transducers and positioners) and pumps:

- Effective January 1, 2022, prevent or control vent gas from at least 90 per cent of the instruments (pneumatic and electric) installed in a calendar year.
- For level controllers that emit vent gas and are installed on or after January 1, 2022: evaluate the actuation frequency during normal operating conditions, and for level controllers that actuate between 0 and 15 minutes, use a relay that has been designed to reduce or minimize transient or dynamic venting or adjust the actuation frequency so that the time between actuations is greater than 15 minutes.
- For pneumatic instruments other than level controllers that emit vent gas and are installed on or after January 1, 2022, ensure that the instruments have a manufacturer-specified steady-state vent gas rate of less than 0.17 m^3/hr.
- Pneumatic pumps installed on or after January 1, 2022, that operate more than 750 hours per calendar year do not emit vent gas.
- Identify pneumatic devices that emit vent gas and are installed on or after January 1, 2022, with a weatherproof, readily visible tag.
- Effective January 1, 2023, for level controllers that emit vent gas and are installed before January 1, 2022: prevent or control vent gas, evaluate the actuation frequency during normal operating conditions and for level controllers that actuate between 0 and 15 minutes, use a relay that has been designed to reduce or minimize transient or dynamic venting or adjust the actuation frequency to ensure that the time between actuations is greater than 15 minutes.

- Effective January 1, 2023, for pneumatic instruments other than level controllers that emit vent gas and are installed before January 1, 2022: prevent or control vent gas, or ensure that the instruments have a manufacturer-specified steady-state vent gas rate of less than 0.17 m^3/hr.
- Exceptions: if it can be demonstrated that a pneumatic instrument that vents gas is needed to maintain safe operating conditions or to achieve a necessary response time and that there is no other way of accomplishing this while still meeting venting requirements above, then that instrument is exempted from the applicable requirement. These exempt instruments must be identified with a weatherproof, readily visible tag.

The operator of record must include in the annual methane emissions report the volumes from pneumatic instruments and pumps, by facility ID, of vent gas emitted (m^3) and corresponding mass of methane emitted (kg).

10.5.9 Vent Gas Limits for Compressor Seals

The following compressor seal testing requirements apply to vent gas from the seals of a reciprocating or centrifugal compressor that is rated 75 kW or more and is pressurized for at least 450 hours per calendar year:

- For any compressor seal that emits vent gas, the duty holder must test the seal at least every 9000 hours that it is pressurized. The test must:
  - have a maximum single point uncertainty of ±10 per cent for a vent rate greater than 0.10 m3/hr;
  - have a maximum total back pressure of less than 1 kPa (includes the back pressure from the measurement device, piping, valving, and fittings) for a vent rate less than 1 m3/hr;
  - include all vents from the compressor seal (for reciprocating compressors, this includes piston-rod-packing vents and drains and distance-piece vents and drains (including purge-system vents) and compressor crankcase vent);
  - include all compressor seals that emit vent gas (either by testing at a single common vent terminus point or at each vent of a compressor seal); and
  - be conducted within 10 per cent of the average revolutions per minute and discharge pressure of the compressor. The average is to be based on the 168 pressurized hours prior to testing.
- The testing point for each compressor seal that emits vent gas must be accessible and clearly identified.
- If a compressor seal has been replaced since the last test, it does not need to be retested until the next annual test.
- Exception: reciprocating compressors with piston-rod-packing vents and drains and distance piece vents and drains (including purge-system vents) that are connected to control do not have to be tested annually. In these cases, gas emitted out of the compressor crankcase is a fugitive emission.

A reciprocating compressor seal (RCS) includes the piston-rod-packing vents and drains and distance-piece vents and drains (including purge-system vents) on an individual throw. The reciprocating compressor crankcase vent is not subject to

control requirements. Gas emitted from the crankcase of a controlled reciprocating compressor is a fugitive emission. For uncontrolled reciprocating compressors, any gas emitted from the crankcase is vent gas from an RCS.

Reciprocating Compressor Seals requirements are as follows:

- Control vent gas from any seal on a reciprocating compressor installed on or after January 1, 2022, with four or more throws.
- Effective January 1, 2023, limit vent gas from the RCS fleet to less than 0.83 m3/hr/throw. The RCS fleet consists of Peridae's reciprocating compressors that are rated 75 kW or more, pressurized for more than 450 hours per calendar year, and either: were installed before January 1, 2022, or were installed on or after January 1, 2022 and have fewer than four throws. The vent gas from the RCS fleet is calculated as the sum of the vent gas volumes for the calendar year for the total number of reciprocating compressors in the fleet divided by the sum of the product of each of the number of hours per calendar year that the reciprocating compressor is pressurized multiplied by the number of pressurized throws for the reciprocating compressor for all reciprocating compressors in the fleet.
- Effective January 1, 2023, the duty holder must bring any RCS with a measured vent gas rate greater than 5.00 m^3/hr/throw to below 5 m^3/hr/throw within 30 days of the measurement date.

Centrifugal Compressor Seals requirements are as follows:

- For centrifugal compressors installed on or after January 1, 2022, limit the vent gas rate to less than 3.40 m^3/hr/compressor. If the measured rate is not below this limit, take action to bring the rate below 3.40 m^3/hr/compressor within 90 days of the measurement date.
- Effective January 1, 2023, for centrifugal compressors installed before January 1, 2022, limit the vent gas rate to less than 10.20 m^3/hr/compressor. If the measured rate is not below this limit, take action to bring the rate below 10.20 m^3/hr/compressor within 90 days of the measurement date.
- Exceptions: vent gas from engine or turbine starts and compressor blowdowns is managed under the OVG limit in Directive 039 Section 8.3 and excluded from the requirements for vent gas limits for compressor seals.

The annual methane emission report must include: the volume of vent gas emitted (m^3) from all compressor seals (including seals in compressors rated less than 75 kW and compressors pressurized for less than 450 hr/yr) by facility ID; the corresponding mass of methane emitted (kg) by facility ID; for each reciprocating or centrifugal compressor rated at least 75 kW and pressurized for more than 450 hr/yr, the following:

- compressor frame serial number or other unique identifier
- legal survey location
- authorization number

- whether the equipment was installed before January 1, 2022, or on or after January 1, 2022
- compressor type (reciprocating or centrifugal)
- number of throws (if reciprocating)
- seal type (dry or wet if centrifugal)
- whether the piston-rod-packing vents and drains and distance-piece vents and drains are controlled
- annual vent gas volume (m^3)
- annual pressurized time of compressor (hours).

The operator of record must base reported compressor seal vent gas volumes on a test result (may include metering), or an estimate based on accepted engineering practices. When the compressor seal vent is tested, the test result is used to estimate the compressor seal vent gas volume for the period until the next test is conducted. If any seals are replaced between tests, an estimate based on accepted engineering practices can be used to estimate the compressor seal vent gas volume for the period from the seal replacement until the next test is done. For further guidance, see AER Manual 015.

10.5.10 Vent Gas Limits for Glycol Dehydrators

Vent gas limits for glycol dehydrators are as follows:

- On or after January 1, 2022, limit methane emissions from each glycol dehydrator installed or relocated, to less than 68 kg of methane/day.
- Effective January 1, 2023, limit methane emissions from the glycol dehydrator fleet to less than 136 kg of methane/day in the calendar year. The glycol dehydrator fleet consists of operating glycol dehydrators in the calendar year that were installed or relocated before January 1, 2022. The methane emissions rate from the glycol dehydrator fleet is calculated as the sum of the mass of methane emissions of the fleet divided by the sum of the number of days in the year that each glycol dehydrator in the fleet operated.
- Exceptions: vent gas from glycol regenerators used in refrigeration processes is managed under the OVG limit in Directive 039 Section 8.3 and excluded from the requirements for vent gas limits for glycol dehydrators.
- Refer to D039 for reporting requirements for active glycol dehydrators.

10.5.11 Additional Requirements

Provided that all other requirements relating to Vent Gas Limits and Fugitive Emissions Management in Directive 039 Section 8 are met, Section 8.031 of the OGCR permits the connection of pressure-relieving devices at oil production batteries to open tanks (pop tanks).

- Hydrocarbon products stored in atmospheric storage tanks at gas plants, compressor stations, and gas batteries must not have a true vapour pressure

of more than 83 kilopascals (kPa) at 21.1°C if the tanks are vented to the atmosphere.

- Unless directed by the AER to flare, incinerate, or conserve all casing gas and tank-top gas, temporary, short-term venting is allowed at wells (e.g. for well unloading and liquid cleanup), facilities, batteries where conservation is in place, and pipelines with the following conditions:
  - gas must contain less than 10 mol/kmol H_2S and must not result in exceedances of the AAAQO outside the lease boundary
  - gas must not contain any free hydrocarbon liquid (if free hydrocarbon liquids are present in the produced gas, a flare, or other gas combustion device, and liquid separation must be used)
  - all liquids must be separated and contained in accordance with the storage requirements of Directive 055
  - total gas volume must not exceed 2.0 10^3 m^3 and the duration must not exceed 24 hours
  - conduct notifications
  - Note: the AER field centre may consider alternatives to these requirements should special circumstances warrant.
  - short-term vent gas emissions must not exceed the OVG limits
- Residents and the appropriate AER field centre must be notified of nonroutine venting within 500m and must comply with Directive 056 in respect of providing information about continuous flaring, incinerating, and venting to persons entitled it. Refer to D039, Section 3.8 for nonroutine venting notification requirements.
- Vent gas must not constitute an unacceptable fire or explosion hazard and must comply with the spacing requirements in Directive 039. Venting must also not occur closer than:
  - 25 m from any flame-type equipment (for diesel engines equipped with air intake shutoff device, see Directive 036: Drilling Blowout Prevention Requirements and Procedures)
  - 50 m from a wellhead for vent stacks other than surface casing vents
  - 25 m from a wellhead for heavy oil/bitumen well, storage tank, or other ignitable vapour including lined earth excavations used for waste oil storage.
- A flame arrester or equivalent safety device, or proper engineering and operating procedures (e.g. sufficient sweep gas velocity) must be used on all vent lines connecting oil storage tanks to flare or incinerator stacks.
- When equipment is used to control vent gas, design and operate control equipment to conserve or destroy at least 95 per cent of vent gas captured, with the equipment operating a minimum of 90 per cent of the time vent gas is emitted.

10.5.12 Requirements for Venting Gas Containing H_2S or Other Odorous Compounds

- Gas containing more than 10 mol/kmol H_2S must not be vented to the atmosphere (excluding crude bitumen batteries). This includes gas off stock tanks, PSVs, and equipment blowdown systems. Sour pressure-relief valves must be tied into flare systems if the gas contains more than 10 mol/kmol H_2S or result in off-lease H_2S odours.
- Venting and/or fugitive emissions must not result in any H_2S odours outside the lease boundary. Venting and/or fugitive emissions must not result in any offensive hydrocarbon odours outside the lease boundary that, in the opinion of the AER, are unreasonable either because of their frequency, their proximity to surface improvements and surface development (as defined in Directive 056), their duration, or strength. The AER recommends that PSVs and blowdown systems be connected to a flare system where such systems are installed.
- Venting must not result in exceedances of the AAAQO outside the lease boundary.
- Pressurized tank trucks or trucks with suitable and functional emission controls must be used when transporting sour fluids from upstream petroleum industry facilities.

10.5.13 Noncombustible Vent Gas Requirements

Release of inert gases such as nitrogen and carbon dioxide from upstream petroleum industry equipment or produced from wells may not have sufficient heating value to support combustion. These gases may be vented to atmosphere subject to the requirement that noncombustible gas mixtures containing odorous compounds including H_2S must not be vented to the atmosphere if off-lease odours may result. Alternatives to venting such gas include flaring or incinerating with sufficient fuel gas to ensure destruction of odorous compounds.

10.5.14 Fugitive Emissions Management Program (FEMP)

AER requires all licensees to have a documented FEMP. This only applies to sites with active wells or facilities that are outside of the Peace River area.

The FEMP must be designed to reduce fugitive emissions, contain the elements in accordance with Directive 060 (Appendix 12, Mandatory Elements of a Fugitive Emissions Management Program), and be updated to reflect any changes to operations. Refer to AER Manual 016, How to Develop a Fugitive Emissions Management Program.

10.5.15 Fugitive Emissions Surveys

Fugitive emission surveys must be conducted at the frequency specified in above.
.3. Facilities that are designed to vent all received and produced gas do not require

fugitive emission surveys. Survey frequency may be adjusted to align with operational visits at sites where access is restricted. Justification must be provided for the adjusted survey frequency to the satisfaction of the AER upon request.

Fugitive emission surveys must be conducted using one of the following:

- An organic vapour analyzer that detects hydrocarbons at a concentration of 500 ppm and is operated in accordance with the United States Environmental Protection Agency's (EPA's) Method 21: Determination of Volatile Organic Compound Leaks;
- A gas-imaging camera that can detect a stream of pure methane gas emitted at a rate of 1.0 gram per hour or less at a distance greater than 6 m under controlled laboratory conditions; or
- Other equipment or methods that are equally capable of detecting fugitive emissions.

Further guidance on survey methods and equipment can be found in AER Manual 016.

The following must be surveyed:

- Equipment components with hydrocarbon throughput;
- Hydrocarbon gas-driven pneumatic devices;
- Tank-top equipment, including thief hatches and gauge-board assemblies;
- Surface casing vents and the area around the wellbore;
- Equipment used to destroy vent gas, including burners, flare ignitors, pilots and combustors; and
- Equipment used to conserve vent gas, including vapour recovery units and vent gas capture systems.

Individuals conducting fugitive emissions surveys must be trained to use the fugitive emissions survey equipment and all equipment used to detect or quantify fugitive emissions must be operated, serviced and calibrated to the manufacturer's recommendations.

10.5.16 Fugitive Emissions Screening

Annual fugitive emissions screenings must be completed at all well sites except for:

- Well sites that have been included in a fugitive emissions survey that year;
- Well sites where all received and produced gas is vented; and
- Well sites with only oil sands evaluation wells or test holes.

Fugitive emissions screenings must use one of the following:

- Audio, visual or olfactory methods;
- Soap solution;
- Other methods or equipment that is capable of detecting fugitive emissions, such as unmanned aerial vehicles or truck mounted sensors; or
- Fugitive emissions survey methods and equipment.

Further guidance on screening methods and equipment can be found in AER Manual 016. Individuals completing fugitive emissions screenings must be trained to identify common sources of fugitive emissions.

10.5.17 Repairs

Sources of fugitive emissions must be repaired or action taken to eliminate fugitive emissions within 24 hours of identification if fugitive emissions are causing off-lease odours, are the result of a failed pilot or ignitor on a flare stack or have the potential to cause safety issues. All other sources of fugitive emissions must be repaired or other action taken to eliminate fugitive emissions within 30 days unless any of the following applies:

- A major shutdown is required to complete the repairs and there are no safety issues, with repair at the next planned shutdown or as directed by AER.
- The fugitive emissions, measured using US EPA Method 21, have a hydrocarbon concentration less than 10,000 ppm, then no repair is required, however these emissions must be quantified at each subsequent survey until the source is repaired.
- The fugitive emissions are from surface casing vent flow or gas migration, which is to be managed in accordance with the timelines in Interim Directive 2003-01.

The integrity of any repair must be confirmed seven days of the component being brought back into service. The source of fugitive emissions must be tracked for subsequent repair unless the repair is completed immediately upon emissions detection. It is recommended that a source that needs to be repaired be physically tagged and the tag removed once the integrity of the repair has been confirmed.

10.5.18 Reporting

Annual reports must include the following:

- The volume of fugitive emissions (m^3) by facility ID, including any additional volume detected during an AER survey.
- The corresponding mass of methane emitted (kg) by facility ID.
- For any fugitive emissions site survey, tank survey or well screening during the reporting period the type of survey or screening (site survey, tank survey or well screening, the date the survey or screening was completed per site by facility ID and the number of identified sources of fugitive emissions per site by facility ID.

10.5.19 Alternative Fugitive Emissions Management program

The AER will consider innovative and science-based alternatives to the fugitive emissions management program prescribed in Directive 039. Alternative programs may incorporate the use of various technologies such as unmanned aerial vehicles, vehicle-mounted sensors and continuous monitoring devices to detect, track, repair

and report fugitive emissions. A proposal to use an alternative program must be submitted to AER for review and approval. Until such approval is obtained, the prescribed program must be followed.

10.5.20 Methane Emissions Record Keeping

Records must be retained for four years from the day they were created, unless otherwise noted, and provided to the AER upon request:

- Calculations, by site, used to determine the monthly volume and monthly mass of methane from each of the following sources: defined vent gas, instruments and pumps, compressor seals, glycol dehydrators, and fugitive emissions.
- The hours of equipment usage or activity rates used in the monthly calculations and the supporting information, such as gas compositions, equipment test results, equipment or component numbers, gas density, conversion factors, and emission factors used in the monthly calculations.
- For fugitive emissions, the FEMP that is in effect, sites where access is restricted and the reason for the restricted access, completed training programs and valid certifications for all individuals conducting fugitive emission surveys and screenings, and survey results containing the information set out in Directive 039 Appendix 13.
- Inventory, updated annually, of pneumatic instruments and pumps that emit vent gas and are installed before January 1, 2022, including tracking identifier or serial number, legal survey location and facility ID, installation or modification date, make and model, device type (categorize as pump, level controller, non-level controller), for level controllers that vent gas, the actuation frequency and for instruments that are exempt under the Vent Gas Limits for Pneumatic Devices exemption section, the reason for the exemption (safety or response time).
- Inventory, updated annually, of pneumatic instruments that emit vent gas and are installed on or after January 1, 2022—as well as any other instruments installed in the calendar year and included in the total number of instruments under the Vent Gas Limits for Pneumatic Devices requirement 1—including tracking identifier or serial number, legal survey location and facility ID, installation or modification date, make and model, device type (categorize as level controller or non-level controller), for level controllers that vent gas, the actuation frequency, and for instruments that are exempt under the Vent Gas Limits for Pneumatic Devices exemption section, the reason for the exemption (safety or response time).
- Calculation demonstrating that the percentage of pneumatic instruments installed on or after January 1, 2022, that emit vent gas does not exceed 10 per cent of the total number of instruments installed in the calendar year.
- For pneumatic pumps that emit vent gas and are installed on or after January 1, 2022, inventories, including tracking identifier or serial number, legal location and facility ID, installation or modification date, and make and model.

- Documentation that demonstrates that control equipment meets the requirements for vent gas control in Directive 060, Section 8.7.
- The MRRCP that is in effect.
- For sites with first production or equipment installed before January 1, 2022, the dates of equipment changes for vent gas emissions management.
- The RCS fleet average vent gas rate calculations.
- Inventories of reciprocating and centrifugal compressors rated at least 75 kW, including compressor frame serial number or other unique identifier, compressor power rating (kW), legal location and facility ID, whether the equipment was installed before or after January 1, 2022, license number and licensee, compressor type (reciprocating or centrifugal), number of throws (if reciprocating), seal type (dry or wet if centrifugal), whether seal vent is controlled or uncontrolled, control device operating time, where applicable, compressor seal change-out date, the number of hours monthly a compressor was pressurized, compressor seal test results, in m^3/hr, compressor seal test dates, and the type of meter used for the compressor seal test.
- The calculations for determining the fleet average methane emissions rate for glycol dehydrators.
- Records must be provided in electronic format within 30 days of a request from the AER.

Annual Methane Emission Report templates for Compressors, Fugitives and Volume Mass for use in bulk uploading are available on the AER OneStop landing page.

10.6 Spill Preparedness and Response

10.6.1 Introduction

Pieridae has a corporate ERP and is a member of availalbe oil spill cooperatives in which it operates. Refer to Section 11.0 Corporate ERP. In Western Canada it is a regulatory requirement to be a member of an oil spill cooperative (Western Canadian Spill Services or WCSS) or maintain an equivalent oil spill contingency plan. The WCSS is in place to: act as a vehicle to communicate with regulators and stakeholders related to spill preparedness issues; provide members with an oil spill contingency manual that supplements a corporate ERP; maintain initial spill response equipment caches throughout the cooperatives and backup response equipment for larger spills; and hold annual training courses and equipment deployment exercises.

This procedure is intended the supplement the corporate ERP and provide reference for spill prevention and spill response activities. This section will cover:

- Spill prevention;
- Spill response and reporting;

- Spill safety;
- Spill hazards;
- Water spills;
- Land spills;
- Effects of spilled hydrocarbons on domestic animals, fisheries and wildlife;
- Effects of produced water spills;
- Containment and recovery techniques; and
- Spill waste disposal.

10.6.2 Spill Prevention

To a large extent, effective spill response is dependent on the amount of planning that is undertaken before a spill occurs. Sound planning will help reduce the number of spills, improve the success of response activities, reduce environmental impact, decrease conflict with regulatory agencies and the public, and lower spill response costs. Spill planning is a continuous process that requires commitment, cooperation and input. Effective spill prevention includes:

- Company policy and spill strategy;
- Planned inspections;
- Corporate ERP and specific ERPs (as required);
- Equipment readiness (know local contractors, mutual aid and area spill cooperatives);
- Training; and
- Public consultation (membership in WCSS).

There are various provincial regulations that apply to operations; however, the message is consistently “keep it clean”. Good housekeeping is very important. It is also important to be aware of operational activities that could result in a spill:

- Freshwater aquifers must be protected while drilling.
- Drilling mud must be disposed of in accordance with regulations.
- Overfill shut-off systems on production/storage tanks should be in good working order.
- High/low pressure switches should be installed and working properly.
- All storage areas greater than $5m^3$ in volume must be diked. The dike must have the capacity of 100% of the volume of the largest tank or 110% of the largest tank +10% of the aggregate volume of the remainder of the tanks. The diked area must provide secondary containment through compacted clay or a synthetic liner. Refer to specific provincial regulatory storage requirements for specific requirements.
- There are no breaks in any dikes.

- Dike drains must always be closed. If dikes are drained, follow the surface runoff/discharge procedure.
- All operational areas in close proximity to water must be diked.
- All dikes must be maintained in good condition and kept free of vegetation or other combustible material.
- Storage tanks will be visually inspected and documented monthly.
- Storage tanks must be integrity tested regularly. Above ground storage tanks (ASTs) must be tested every five years, underground storage tanks (USTs) must be tested every three years.
- Check gauge boards regularly. If gauge boards are not in place, then the tanks must be dipped.
- Load lines must have secondary containment (or drip trays are recommended for temporary fixtures).
- Equipment must be maintained to ensure drips and/or small leaks are repaired.
- It is recommended that each operated facility (gas plant and/or oil battery) have certain emergency response spill equipment on site including: absorbent pads, booms, rags, hazardous waste bin and/or soil waste bin.

In addition, there are a number of proactive procedures that field operations personnel should consider to prevent spills:

Wells

- Ensure adequate lubricant application of the stuffing box on pumping oil wells. In environmentally sensitive areas, consider using a second stuffing box or a canister to reduce spills in the event of rod breakage.
- Consider that wellhead stuffing box has built-in BOP capability, if necessary.
- Address need for a secondary pressure switch.
- Ensure radigan rubbers are checked and replaced, if necessary, each time well is serviced.
- Inspect bridle cables on all pump jacks for fraying and replace, if necessary.
- Consider wellhead barricades to prevent vehicle collisions, where necessary.
- Ensure surface casing valve is open and directed away from wellhead and monitor for flow.
- Ensure equipment is grounded.

Pipelines

- Ensure an effective corrosion monitoring/mitigation plan is in place.
- Check that pipeline warning signs are in place on all road and watercourse crossings, and display correct information.
- Be a member of One-Call organizations.
- Ensure pipeline rights-of-way are patrolled regularly.

- Check that all aboveground structures are adequately protected.
- Verify that downstream pipeline pressures on lines that cross large watercourses are monitored.
- Conduct regular visual inspections of river and creek crossings.
- Implement a plan to monitor high-risk pipelines.
- Determine that all inlet line headers are protected by check valves.
- Confirm that function tests are conducted on ESD systems annually.
- Ensure cathodic protection is installed on all operating and discontinued lines.
- Maintain and monitor chemical pumps.
- Ensure pressure control valves are installed and working.

Facilities

- Conduct a facility walk-around prior to leaving the facility.
- Ensure current tank integrity assessments are complete and documented.
- Ensure tanks and dikes are of regulation size to hold the production volumes during unattended hours of operation.
- Confirm that pop tanks are of adequate size and kept empty.
- Ensure dikes and liners are adequately maintained.
- Consider more diking if the facility is located in an environmentally sensitive area.
- Check for containment around chemical storage areas.
- Consider bulk storage to replace chemical drums.
- Check chemical pumps daily.
- Determine whether “no-flow” controls are installed on recycle pumps.
- Ensure leaks and drips from recycle pumps are contained and collected.
- Ensure all lines indicate flow direction and contents, and/or are otherwise marked.
- Check that all valves are tagged to prevent wrong operation.
- Ensure spill control devices are installed on truck loading lines.
- Ensure truck loading lines terminate inside the tank dike.
- Determine if the line goes into the top of the tank for truck unloading.
- Check if the scrubber drain is tied into a common drain system or tank.
- Determine if there is a high pressure relief on the discharge side of all high-pressure positive-displacement pumps.
- Verify that fired equipment is inspected regularly.
- Ensure all open-ended piping, ports, and dead-end valves are sealed.

10.6.3 Spill Response

Pieridae recognizes its responsibility for its operations and the effects that these operations have on employees, landowners, the public and the environment. Although facilities and operating procedures are designed to prevent upsets that could result in a spill, spills may occur.

If a spill occurs, the Emergency Coordinator in consultation with the On-Scene Commander must immediately assume overall responsibility for coordination of response actions. In an emergency situation it is imperative that employees and contractors unite as a team to effectively handle the situation. Refer to Section 11.0 Corporate Emergency Response Plan.

Once a spill has occurred, it is important to initiate a well-organized response that includes shutting in the source, initiating containment and recovery, clean-up and reclamation. As no two spills are alike, it is impossible to provide a rigid set of instructions. Trained personnel must adapt to the unique circumstances of the spill and use available resources. If one technique fails, a new approach or improvisation of existing methods must be attempted. In general, spill response should be approached as follows:

Spill notification - is the starting point for initial response. Documentation starts at this stage and must be continued until the site is reclaimed. Activate the ERP, mobilize resources, confirm spill and shut-in the spill source.

Assessment of incident factors - includes the identification of hazards associated with the incident (hazard assessment), the site assessment and security of the impact.

Set objectives – following the site assessment, the response team should develop an action plan that includes clear and concise objectives. The priorities are to protect human life, property and the environment. An action plan that outlines objectives will likely be developed by company personnel with input from regulatory agencies.

Incident control – includes containment, recovery and spill management with a focus on communication. Control is accomplished by having a defined emergency coordinator with authority and availability to resources.

Evaluation – the spill response must be evaluated on a continuous basis and changes made to the action plan if necessary. The entire response team must be briefed when changes occur.

10.6.4 Spill Reporting

Spills must be reported depending on the product and volume spilled and in consideration of provincial, federal and Pieridae reporting requirements. Various

reference materials are contained in this HSE Program, refer to the various sections as described below depending on the nature of the spill.

- Refer to Section 12.3 Regulatory Reporting Requirements.
- Refer to Section 12.4 Pieridae Internal Incident Reporting Requirements.
- Refer to Section 6.7.7 TDG Emergency Reporting.
- Refer to Section 9.12.11 Reporting Pipeline Hits and DPP Incidents.

It is recommended that regulatory authorities be contacted as soon as possible when reporting a spill (even if not all information is known especially in the case of sour product). Additional support and direction regarding regulatory reporting can be obtained from environmental consultants. If an Alberta Environment approval is in place at a facility and a spill occurs, check the approval to ensure that proper reporting and follow-up documentation is completed (i.e. sour gas plants must report and follow-up with a written report or warnings and/or fines could be imposed).

10.6.5 Spill Safety

During an initial spill response, personnel often feel under pressure to make quick decisions with very little time for planning or consultation. Therefore, it is important to:

- Protect yourself;
- Call for backup;
- Protect lives;
- Minimize losses to private, public and company property; and
- Minimize adverse environmental impact.

It is important that the response team have a strong commitment to safety. Personnel must ensure they work safely at all times and that their actions do not jeopardize the safety of fellow responders. Applicable standard operating procedures such as contractor orientation, pre-job safety meetings, safe work permitting, ground disturbance and atmospheric testing must be followed.

Each member of the response team must use common sense and when in doubt, check with the work site supervisor. It may be appropriate to have a safety specialist assigned to the response team. Additionally, spill responders must:

- Understand the hazards associated with the spill and identify escape routes for each work station;
- Be familiar with the locations and operations of safety equipment;
- Wear appropriate PPE;
- Follow standard operating procedures;

- Communicate concerns to work site supervisors and report near misses and incidents;
- Work in a responsible manner at all times and follow good housekeeping practices; and
- Work safely at all times and not assume that a safety person is solely responsible for safety.

For spills associated with pipelines there are various issues that must be considered, depending on the nature of the spill.

10.6.6 Spill Hazards

Spill responders will need to know the characteristics of the spilled product to identify hazards and safely assess the site and develop a response strategy. A safe work permit should be issued for spill response to methodically consider the hazards and controls.

The following section provides guideline for operators when responding to oil, gas and produced water leaks. However, extreme caution should be exercised if the leaked product is sour and safe work procedures for sour (H_2S) products should be followed.

Personnel should be aware of the properties of the products to be handled and have access to MSDS sheets. The following summarizes some of the characteristics of oil, gas and produced water.

Oil

- The physical properties of crude oil effluent vary considerably based on the reservoir from which it is produced.
- Oil in a reservoir is accompanied by solution gas. As the pressure is decreased, the amount of gas in solution is reduced; therefore, the amount of gas liberated with the effluent at a leak can be estimated for each pipeline by referring to the gas/oil ratio of the produced fluid.
- Where saltwater is produced with the oil, special procedures may be required for remediation.
- Flowlines are usually small diameter pipelines of relatively short distance and the quantity of line fill (or volume) is not significant to cause extended bleed down time.
- Large diameter flowlines are unpredictable and the pipeline can appear to be depressurized with the flow of oil and gas completely stopped for a few minutes only to start flowing again as liberated solution gas expands pushing out slugs of oil which can accumulate in low sections of the pipeline.
- Provisions should be made to allow for depressurizing flowlines through production facilities, thus decreasing bleed down time and minimizing uncontrolled release of crude oil effluent at the leak.

- The potential hazards encountered at any particular pipeline leak will vary depending on the physical properties of the crude oil effluent, terrain, weather conditions, etc.
- The volume of product spilled will vary in proportion to the size of the rupture, the pipeline flow rate, time to shutdown/isolate the line, etc.
- Workers should approach the leak site from the upwind and uphill side if possible. Gases released from crude effluent, being heavier than air, will tend to flow downward and into low-lying areas where flammable mixtures may be formed.
- Downwind and low lying areas should be checked with appropriate gas detection equipment for concentrations within the flammability limits.

Gas

- Gas products handled in pipeline systems are a mixture of methane with propane, ethane, butane and other natural gases, covering a wide range of hydrocarbon composition.
- Potential hazards experienced at any particular pipeline leak will vary extensively based on the gaseous mixtures, terrain and weather conditions.
- Workers should approach the leak site from the upwind and uphill side if possible.
- Until the actual limits of a gas plume are established, workers should assume a downwind flammability level exists.
- Methane is lighter than air and will dissipate quite readily.
- Ethane, propane, butane and other natural gases are heavier than air and will tend to flow downwind or into low lying areas where flammable mixtures may be formed.
- Downwind and low lying areas should be checked with appropriate gas detection equipment for concentrations within the flammability limits.
- Compressibility of the gaseous mixtures, diameter/length of the pipeline, operating pressure and the extent of the leak will determine the blowdown time required. Provisions should be made to allow venting of pipeline pressure through blowdown or flare systems at process facilities to decrease blowdown time and minimize uncontrolled release of gas at the rupture site.

Produced Water

- Steel line pipe (bare or internally coated) and nonmetallic line pipe may be utilized in water injection systems. Repairs should be completed in accordance with appropriate procedures for specific material in service.
- There is a possibility that gases entrained in produced water may be liberated at the leak site (i.e. gases in flammable quantities or toxic gases such as H_2S). Until the existence of gas vapors has been verified, workers should approach the area from the upwind (and uphill) direction.
- In the case of produced water (saltwater) spills, contamination, cleanup and restoration should be assessed in consultation with an environmental professional.

- Where spilled water contains biocides and/or corrosion inhibitor, special precautions for handling hazardous chemicals must be adhered to during cleanup and disposal of the spilled fluid. Consult supplier MSDS as required.

There are also other flammability, health and physical hazards that should be considered.

Flammability

- There is potential for uncontrolled ignition and explosion.
- Although low-flash-point hydrocarbons, like condensate or gasoline present the greatest risk of fire and/or explosion, heavier products like diesel fuel can ignite if the conditions are right.
- Flammable vapor from a spill can migrate off-site, creating a hazard area that extends beyond the obvious spill perimeter.
- During the normal weathering process, light ends will be released at varying rates. Fire and explosion hazards are most prevalent during the early stages of a spill but may exist during the entire clean-up period. Some clean-up techniques (i.e. hot water flushing) can increase the amount of flammable vapor.
- Spills which have a protective cover such as ice, snow, muskeg or other vegetation, may be extremely flammable under the cover and after the cover is removed.
- Ambient air temperatures can have a significant impact on the rate at which vapors are released. As temperatures increase so will the rate of volatilization.

Health Hazards

- Hydrocarbon vapors, generally heavier than air, will displace air and in higher concentrations create an oxygen-deficient atmosphere.
- Hydrocarbons may also contain H_2S, which is extremely poisonous and lethal at low concentrations. Personnel without H_2S Alive training should not be part of the emergency response team if H_2S gas is present.
- Hydrocarbons may produce a narcotic effect on personnel exposed to high concentrations. Giddiness, headaches, dizziness and nausea are generally observed as warning symptoms. First responders exposed to hydrocarbon vapors may experience a loss of judgment, disorientation, dizziness and light-headedness.
- Some spills may also include toxic and/or carcinogenic compounds such as benzene, toluene, ethylbenzene and xylene (BTEX), chemical additives and corrosive fluids like salt water. Worker exposure to compounds such as these must be kept below levels outlined in OHS regulations or the appropriate PPE must be used.
- Short-term exposure to crude oil on skin is normally not a problem; however, long-term exposure can cause skin to dry out, crack, turn red, itch or swell. Oil on skin is also known to increase the likelihood of sun-burn.
- Site conditions that can contribute to hazards at the spill (i.e. broken ice and frigid water, oil coating on rocks creating a slipping and tripping hazard, etc.).

Physical Hazards

- Working in close proximity to heavy and specialized equipment.
- Extreme temperatures, high winds.
- Water hazards, when containment and recovery require the deployment of equipment in open surface water or in ice conditions.
- Slipping and tripping where the surface is slippery, muddy or unstable.
- Working in areas where there are ground disturbances related to underground pipelines, utilities and overhead power lines.
- Working in confined spaces
- When the spill is in an area with multiple land uses or where there is heavy traffic.
- In areas where responders are in close proximity to wild animals like bears or snakes.
- Adverse conditions that require demanding physical activities.

There are unique hazards associated with pipeline spills that should be considered as follows. Refer to the Pieridae Pipeline Integrity Management Program manual for additional and specific information with respect to pipelines.

- To ensure that the pipeline is ready and safe for repair, the work site supervisor will make certain that proper arrangements have been made to control product release and cathodic protection is shut off.
- If spilled product at the leak site is known to be toxic, or if the possibility of an oxygen-deficient atmosphere exists, approved respiratory protective equipment must be available.
- Personnel and equipment will not be permitted in the area of a leak until the contaminated areas have been clearly defined. Suitable warning signs are to be placed where the nature of the product and the likelihood of public access to the area warrant. DANGER and CAUTION placards are suggested for such purposes. Danger placards will be placed in the immediate vicinity of the leak. Caution placards will be placed in such outlying areas as necessary.
- In instances where pipeline repairs are temporary or work is interrupted or delayed, the leak site will be barricaded and marked with warning lights or fenced to protect against the possibilities of incidents.
- Surface terrain, direction and velocity of prevailing winds and proximity to possible sources of ignition, such as may be found on highways, railroads, or in residences will be carefully considered. Roadblocks, if necessary, are to be erected immediately. A windsock will assist the repair crew in detecting changes in the wind or air currents.
- A combustible gas meter is to be used to determine the concentration of petroleum vapors in the area and to define the hazardous work area. Refer to Section 5.11 Gas Detection Equipment.
- Certain rocks can produce sparks when violently struck with either ferrous or nonferrous metal. In geographic areas where such minerals are present and where volatile flammable liquids may be encountered during excavation, keep

the area well drained of liquid to decrease the risk of injury to personnel from flash fires.

- Whenever possible, temporary pipeline repairs are to be made without welding or torch cutting. Permanent repairs requiring welding or cutting will be delayed until oil or product cleanup and vapor dissipation have been completed.
- Line cuts, when required, are to be made with pipe saws or with mechanical cutters.
- Because of the possibility of electrical currents on the pipeline, an electrical bond is to be made across all proposed points of separation before the line is cut or a flange joint is separated. If replacement pipe is required, the pipe joint or joints will also be bonded. The bond should not be removed until repairs have been completed.
- If welding is to be performed all oils, products and saturated earth is to be removed both from within and around the excavation. The excavation and its surrounding area must be checked for flammable vapors. It may be necessary to spread dry dirt around and on the bottom of the excavation.
- Upon completion of the repair, necessary tests and operating checks must be made before placing the line in service.

Following the completion of permanent repair, the site is to be restored to its original condition.

10.6.7 Water Spills

Under most conditions oil will float on water and provide the opportunity for containment and recovery. There is a small volume (approximately 5%) of soluble hydrocarbon associated with a crude oil spill. This portion of the spill is of concern because it is extremely difficult to recover, is toxic to living organisms at lower concentrations and can cause altered water taste and odor.

Some heavier oils may sink into the water column and are more difficult to contain and recover. Spills of blended heavy and light oils (diluents) tend to float initially and then sink as the product weathers. The spreading of a hydrocarbon spill in a watercourse can be influenced by a number of factors including:

- **Force of gravity –** following a spill, an oil slick normally spreads fairly quickly with the inner portions having more thickness than the outside edges.
- **Type of product –** lighter oils tend to spread more readily than heavier oils. Oil mixed with water will increase the viscosity of the product and reduce spreading rate.
- **Temperature –** oil spreads more readily in warmer temperatures.
- **Wind –** wind can accelerate the speed of an oil slick (approximately 3% of wind speed); move the slick from shoreline to shoreline or against one shoreline and even blow the slick upstream under certain conditions. Strong winds can create water turbulence that promotes emulsification. Strong winds (in excess of 16km/hour) can cause the slick to break up into streaks or windrows on larger bodies of water.

- **Currents –** normally oil will meander downstream at the same speed as the surface water with accumulations of oil collecting in backwaters and eddies. In general, the faster the current the more difficult it is to deploy containment and recovery equipment.
- **Debris and Natural Particles –** the presence of debris can slow down the spreading of an oil slick and create a hazard for the spill response team. Oil particles can adsorb onto particles in the water (clay and other loose materials) and settle into the water column.
- **Snow and ice –** oil spilled on snow-covered ice will adsorb into the snow and can migrate into the porous ice surface. If the spill is under solid ice, it will move with the current with relatively large portions of the oil collecting in rough areas or pockets on the underside of the ice.

10.6.8 Land Spills

When oil is spilled on land a portion will evaporate, some will remain on the surface and some will penetrate into the soil profile. The portion that evaporates is a concern as the vapors may be toxic and may present a risk of uncontrolled ignition when mixed with air. Vapors tend to drift with the wind and accumulate in low-lying areas. If the spill seeps into the soil or the spill originates underground, the hydrocarbon and petroleum vapors may travel extensively through the soil (i.e. gravel layers). Oil that remains on the surface can be detrimental to living organisms, including plants, through direct toxicity or by smothering the organisms. The presence of oil on the surface will also affect the proper wetting of the soil. In drier conditions, surface oil causes the water to run off or pool rather than seep into the ground. In wet forested soils, surface oil causes the organic layers to become excessively wet by stopping plant transpiration and reducing evaporation. Oil that penetrates into the soil will move downward until it is contained or, it reaches a more impervious formation or it reaches the water table. The oil then begins to move laterally and can contaminate large quantities of water. A fluctuating water table can cause the spilled product to reappear at the surface, creating additional problems, or move further down into the soil. The penetration of oil into a soil will depend on a number of factors including:

- **Type of Oil** – lighter oils penetrate more readily.
- **Type of Soil** – oil penetrates more readily in coarse soils (e.g. sandy soils).
- **Temperature** – oil tends to become more viscous in colder temperatures and not penetrate as readily into the soil profile.
- **Slope of the Land** – oil will tend to run off steeper slopes.
- **Soil Moisture Content** – penetration will increase in dry soil conditions.
- **Ground Cover** – thick ground cover tends to restrict the vertical movement of oil.
- **Presence of Impermeable Layers** – layers of bedrock, frost, etc. will restrict the downward movement of oil.

Oil that penetrates into the ground can kill vegetation and can create a nutrient imbalance. It can also affect the numbers of micro-organisms in the soil. Populations of bacteria and fungi that break down organic material, including oil, will increase provided the necessary nutrients are available, oxygen is present and temperatures are adequate.

10.6.9 Effects of Spilled Hydrocarbons on Domestic Animals, Fisheries and Wildlife

Following a spill, the tendency is to evaluate the effects on animals based on the more obvious signs like direct toxicity or a temporary loss of habitat. Not fully recognized is the effect that a spill has on the micro-organisms that contribute to a healthy biological community. The effect of a hydrocarbon spill on animals will depend on a number of factors including the type of product, degree of contamination, environmental conditions, etc. In general, the effects on animals are:

- Domestic animals are usually affected if they inhale the vapors or ingest the spilled hydrocarbon.
- Fish are affected through direct toxicity, by eating contaminated food and through contact of floating egg masses with surface oil. Although different species of fish have varying tolerances to oil, in general, fish in the larval and early juvenile stages are at greatest risk.
- Birds are affected through ingestion of petroleum, external oiling, egg oiling and the loss of habitat. Birds ingest oil through feather preening, eating contaminated food and the inhalation of fumes. External oiling causes the matting of feathers and often results in hypothermia and death from cold water and drowning. Bird eggs are very sensitive to petroleum, which can cause high mortality rates, particularly during the incubation period.
- Fur-bearing mammals appear to be most affected through the oiling of their fur, skin and eye irritation, oil ingestion and temporary loss of habitat. Oiled fur becomes matted and loses its ability to insulate the animal.

10.6.10 Effects of Produced Water Spills

During a produced water spill, sodium ions replace many of the calcium and magnesium ions on the soil particles that make up a healthy soil. This unnatural excess of sodium has an adverse effect on soil structure. The soil particles disperse and clog the soil pore spaces; this is commonly referred to as “hard pan” and makes the soil impermeable to water and air. This soil condition requires intensive reclamation to support vegetation. Soils with a heavy clay component are more susceptible than organic or sandy soils. Soil structure is less likely to deteriorate in soils with a high component of organic matter. Although different plant and tree species have varying tolerances to salt water, most will experience no growth or death following a produced water spill. This is due to the accumulation of salts in the cellular tissue or decreased rate of moisture and nutrients entering the root. Salt accumulation will also draw water out of the plant’s

roots. Where soil structure is seriously altered (soil dispersion), it is very difficult or impossible for vegetation to establish.

A large produced water spill in a watercourse where there is not enough fresh water to dilute the salts, will likely kill fish as they are unable to withstand a rapid change in salinity. A fish subjected to increased salinity will coat its gills with mucous to protect itself and literally smother to death.

Larger animals may ingest produced water. This may create a health risk for the animals and should be avoided if possible.

10.6.11 Containment and Recovery Techniques

One of the first priorities in spill response is to stop the source of the spill and to undertake containment of the spilled product so that potential negative impacts are minimized. Stopping the source of the spill will depend on the nature of the spill. For example, a pipeline rupture is normally detected and partially controlled through operations with personnel closing valves in the field to isolate the spill. When spills involve containers, tanks or the actual pipeline spill location, stopping the source is done at the spill site if safe to do so and the appropriate resources and equipment are onsite. Containment activities typically involve: spill assessment; identification of hazards and controls; selection of proper and appropriate containment methods; selection of proper equipment; and consultation with landowners and regulators as deemed appropriate or required.

There are various techniques for the containment and recovery of spills that should be considered depending on the site specific land or water conditions. Techniques include:

Spill barriers (dams, dikes, berms and bellholes or trenches) – the most common method of containing a land spill is to use a combination of dikes, bellholes and trenches around the spill perimeter, with feeder trenches inside the spill itself to move fluids towards a recovery area. Feeder trenches can be constructed by hand or mechanical excavation only when the area has been deemed safe and continuous monitoring is undertaken. Pumps or vacuum units can be used to then transfer the product for disposal.

Water bypass/inverted weirs – this technique is used when it is necessary to allow the natural movement of water to leave the spill site. An inverted weir consists of an earthen berm supported with sand bags or a plastic liner and the appropriate-sized culverts on an angle to contain oil inside the spill perimeter.

Filter fences – can be constructed with pins and chicken wire or snow fence and bales (straw or hay). Filter fences can be effective to contain hydrocarbons without severely affecting the natural movement of water.

Sorbent – It may be appropriate to use a combination of natural sorbents (like straw or hay) with commercial synthetic sorbents. The overuse of sorbents can create a disposal problem and generate unnecessary waste.

Flushing – Flushing or washing hydrocarbon contaminated soils with fresh water may enhance recovery operations but can also cause other safety and environmental issues that should be considered. The site assessment will dictate the appropriate flushing method (i.e. warm water, cold water, pressure etc.). In forested soils where there is a high component of organic matter, immediate fresh-water flushing of produced water spills is a common practice. Flushing a produced water spill in soils where there is a high component of clay can result in extensive damage unless an amendment like calcium is added to the fresh water. Extreme caution is necessary when a nitrate-based solution is applied to the land base if either surface or subsurface water is within range of contamination.

Burning – it may be appropriate, under some spill conditions (i.e. where it is not safe to place men and equipment in the spill area; where the spilled hydrocarbon is lying on water or on an ice layer and using equipment would create more of an impact than burning, if all product has been recovered and it is not feasible to continue recovery, etc.). Prior to burning, it is necessary to formulate a controlled burn plan and obtain approval from the appropriate regulatory agencies.

Containment booms (water spills) – the most common barrier used to contain and direct hydrocarbon spills that are on or near the water surface. Hydrocarbon is collected and recovered. Consideration must also be given to shoreline cleanup.

Ice-slots (winter/frozen water spills) – hydrocarbons spilled under solid ice will flow with the current with portions becoming trapped in pockets under the ice. Ice-slots are an opening in the ice downstream of the spill. Hydrocarbons are collected and recovered. If using this technique, it is important to follow the following assess the weight-bearing capacity of the ice, water depths and current patterns.

10.6.12 Spill Waste Storage and Disposal

Waste materials that are generated from a spill should be minimized and managed so that there are no long-term problems with disposal. Refer to Section 10.3 Waste Management. The following are some of the common waste materials associated with spills and some options for disposal:

Excavated soil – it is common, especially in the case of a pipeline rupture, to excavate soil to locate the pipeline and confirm cause of the spill. If soil must be excavated and it is suspected to be contaminated, it must not be stored directly on the ground as per AER regulations (i.e. contaminated materials or materials possessing the potential to leach must not be stored directly on the ground). Contaminated soil must either be stored on a suitable liner or put into suitable

containment bins or loaded in to trucks for immediate disposal. All surface soil that is not contaminated should first be stripped and salvaged. Clean subsoil should also be carefully separated from contaminated soil to minimize waste volumes.

Contaminated oil – recovered oil should be disposed of at a battery reclaiming plant, oilfield waste management facility, road oiling (following sampling/analysis and regulatory approval) etc.

Contaminated fresh water or produced water – recovered contaminated water should be disposed of at a down-hole injection well.

Contaminated soil – contaminated soil should be disposed of at an appropriate oilfield waste management facility or landfill, or be treated using soil washers or treaters or via methods such as landfarming, incineration, and/or landfill following treatment.

Vegetation/sorbents – used and contaminated sorbents should be disposed of via incineration or at an approved landfill or via landfarming.

Garbage – non-contaminated waste should be disposed of at an appropriate landfill.

Contaminated ice and snow – should be stored in secure containment until it melts and then disposed of at an approved facility

Section 11.0

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11.0 CORPORATE ERP

11.1 Refer to the applicable Core and Supplemental ERPs

Northern AB & BC Foothills ERP

Central AB Foothills ERP

Sierra/Ekwan BC ERP

Section 12.0

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12.0 INCIDENT REPORTING AND INVESTIGATION

12.1 Introduction

Pieridae will report and investigate incidents. The objective of Pieridae's incident management system is to report all incidents, communicate the incidents to staff and utilize the findings to prevent reoccurrence or prevent more serious types of incidents. Incident reports are reviewed by management and are reported to all staff in the HSE Report.

Management strongly supports incident and hazard/near miss reporting and workers must understand that person(s) reporting will be granted immunity from disciplinary action.

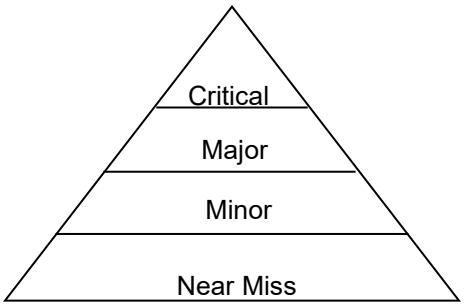
The following procedure will:

- Provide incident definitions and examples;
- Outline incident reporting requirements;
- Outline incident investigation reporting requirements;
- Outline investigation procedures; and
- Describe and reference the appropriate forms.

12.2 Incident Definitions and Examples

Pieridae has categorized incident types for internal reporting purposes as: critical, major, minor and near miss. These internal designations should not be confused with the Corporate ERP Section 11.2 Emergency Levels of alert, level 1, level 2 and level 3 which are prescribed by the AER. In theory, near misses can lead to minor incidents which can lead to major incidents and ultimately a critical incident. Incident reporting and investigation of incidents at the bottom of the incident reporting triangle ("near misses") should aid in the prevention of the more serious incidents at the top of the incident reporting triangle ("critical").

Incident Reporting Triangle



Incident Types, Definitions and Examples

Type	Definition	Examples
Near Miss	A near miss incident is an event that under slightly different circumstances could have resulted in unintended harm or damage to persons, property or the environment.	• "Close calls" when driving. • Callouts that report problems that are then rectified. • Excessive noise, vibration etc. • Observations that result in maintenance / repair. • Improper callouts / communication problems.
Minor	A minor incident may force a portion of the operation to be temporarily suspended but can be completely handled by work site personnel and equipment and does not involve injury. A minor incident does not present any potential danger to the public.	• A non-reportable spill or release (i.e. a spill contained completely onsite that is less than 2.0 m^3 in volume) • An incident not involving an injury (i.e. slips, trips and falls). • First aid incident. • Equipment failure. • Vehicle accident. • Theft, vandalism or fraud. • Community complaint (i.e. odor, noise, dust etc.).
Major	A major incident is one where the entire work site operation may be temporarily suspended and for which outside services are required.	• A reportable spill or release (i.e. an onsite spill greater than $2m^3$ or any spill offsite). • An emergency flaring event. • Injury accidents (medical aid). • Sour gas release or sour oil spill. • Any fire or explosion on an Pieridae work site.
Critical	A critical incident is defined as any major incident where Pieridae personnel, public safety or the environment is jeopardized.	• Serious sour gas release (requiring evacuation of EPZ). • Spill into a flowing stream or river. • Serious injuries or fatality on an Pieridae work site. • Terrorism (bomb threats). • Media coverage that could create a negative impact on the public image.

In addition to the four incident types categorized as near miss, minor, major and critical, incident reports will also be statistically segregated into sub-types for statistical analysis and comparison to goals and industry. Using the Canadian Association of Petroleum Producers (CAPP) Health & Safety Performance Metrics Reporting (2013), the following will be tracked:

- employee lost time; employee recordable incidents and exposure hours to calculate a TRIF
- contractor lost time; contractor recordable incidents and exposure hours to calculate

TRIF.

- Note: for the purpose of CAPP reporting, a recordable injury is defined as fatalities + permanent total disabilities + lost work day cases + restricted work cases + medical treatment cases.
- In addition to the above incident types, Pieridae specifically tracks the following: regulatory reportable spills; non-reportable spills; and vehicle accidents.
- Incident statistics are reported in the monthly HSE Report. The report includes incident statistics an incident summary for the purpose of sharing information to aid in prevention and to ensure closure.

12.3 Regulatory Reporting Requirements

Incidents must be reported to regulatory agencies as detailed below. Depending on the nature and location of the incident, additional notifications may be required including: landowners, municipalities/local authorities, and various government agencies. Refer to the corporate ERP for additional information.

12.3.1 Alberta OHS

Report any incidents that:

- Result in a death
- Cause a worker to be admitted to a hospital or are a "potentially significant incident" (see regulatory definition i.e. could have caused death or injury)
- Involve an unplanned or uncontrolled explosion, fire or flood that causes a serious injury (or has the potential of causing a serious injury)
- Involve the collapse or upset of a crane, derrick or hoist
- Involve the collapse or failure of any component of a building or structure necessary for the structural integrity of the building or structure.

Report the incident to the OHS Contact Centre at 1-866-415-8690. Pieridae must report these types of incidents on its work sites (i.e. as the prime contractor). Incidents that are reported to OHS, must be investigated. Pieridae must carry out an investigation into the circumstances surrounding the reportable incident and prepare a report outlining the circumstances of the serious injury or accident and the corrective action, if any, undertaken to prevent a recurrence of the serious injury or accident, and ensure that a copy of the report is readily available for inspection by an officer.

12.3.2 Alberta WCB

If an employee is involved in an incident, it must be reported under the following circumstances. (Note: WCB is insurance.) Contractor's must report incidents involving their employees. Report any workplace injuries/illness that result or likely will result in:

- Lost time or the need to temporarily or permanently modify work beyond the date of accident

- Death or permanent disability (amputation, hearing loss, etc.)
- A disabling or potentially disabling condition caused by occupational exposure or activity (poisoning, infection, respiratory disease, dermatitis, etc.)
- The need for medical treatment beyond first aid (assessment by a physician or chiropractor, physiotherapy, etc.)
- Medical aid expenses (dental treatment, eyeglass repair/replacement, prescription medications, etc.).

If an employee is injured, an Employer Report of Injury form must be completed within 72 hours. Completed forms can be uploaded electronically at www.wcb.ab.ca.

12.3.3 Alberta Energy Regulator (AER)

The following incidents must be reported:

- Any unrefined product release of more than 2m3 on lease
- Any substance release that may cause, is causing, or has caused an adverse effect (Adverse effect is defined as “impairment of or damage to the environment, human health, or safety or property.” Adverse effect may be determined by any number of factors, including the following: the chemical and physical characteristics of substance released, the receiving media, the location of the release, and the risk to the environment. The onus is on the person who causes, permits, or has control of the release to determine whether there is a potential for adverse effect.)
- Any substance release off lease
- Any substance release into a waterbody
- Any pipeline release or pipeline break (including during pressure testing)
- Pipeline hits
- Any uncontrolled gas release of more than 30 000m3
- Any well flowing uncontrolled
- Any fire caused by a flare or incinerator
- Any fire causing a loss of more than 2m3 of oil or 30 000m3 of gas, or causing damage to a wellhead
- Any fire that occurs on an oil sands site that results in the deployment of major fire-fighting equipment.

Immediately report the incident to the 24-hour Energy and Environmental Response Line 1-800-222-6514 and provide the following details (use the First Call Form on the AER website as a guide):

- The location and time of the release
- A description of the circumstances leading up to the release
- The type and quantity of the substance released

- Details of any actions taken and proposed to be taken at the release site to contain, recover, and remediate the release
- A description of the release location and the immediate surrounding area

If the incident is a reportable spill or release, an AER Release Report must be completed and sent to the appropriate field centre within 7 days of the incident. The following information is required in the report:

- General information
- Volume details
- Release site details
- Release containment details
- Release impacts
- Pipeline details (if applicable)
- Remediation details
- Additional notifications
- Incident details.

12.3.4 Alberta Boilers Safety Association (ABSA)

Refer to the ABSA manual, and or consult the Chief Inspector when reporting these types of incidents. Types of incidents that must be reported to ABSA include:

- All accidents involving pressure equipment (boiler, pressure vessel, pressure piping
system, fitting, or thermal liquid heating system) that result in damage to property
or injury to, or death of, a person
- Accidents not caused by pressure equipment but having some impact on pressure equipment
- Unsafe conditions including (for example): pressure components found to be faulty in design or manufacture; malfunction of safety devices; improper operation of the pressure equipment; inappropriate components or materials; unauthorized repair or alteration; loss of containment; cracking; corrosion improper repairs; “near misses” (events that could have caused injury or damage).

ABSA has reporting requirements for accidents and unsafe conditions.

For accidents:

- Notify an ABSA office or any ABSA Safety Codes Officer.
- After hours: for deaths or other serious accidents, call the Edmonton switchboard at (780) 437-9100. The message will provide after-hours phone numbers for contact. For non-critical accidents, notify ABSA the next business day.

Provide the following information:

- injuries
- deaths
- severity of damage
- equipment involved
- contact name and phone number
- availability of the accident site for investigation
- other persons who have been or will be notified
- Complete and submit a written report by mail as soon as possible. Refer to the ABSA Accident Report Form (AB-97).

For Unsafe Conditions:

- Call or e-mail an ABSA office or any ABSA Safety Codes Officer.
- After hours: if the situation is critical (posing immediate danger), call the Edmonton switchboard at (780) 437-9100. The message will provide after-hours phone numbers for contact. For non-critical situations, notify ABSA the next business day.
- Complete and submit a written report by mail as soon as possible. Refer to the ABSA Unsafe Condition Report Form (AB-139).

12.3.5 Alberta – Electrical Incidents

As per the Safety Codes Act there is a requirement to report electrical incidents. STANDATA released the information bulletin to remind industry stakeholders and members of the public in Alberta that all electrical incidents are required to be reported to the Provincial Electrical Administrator. Reporting of Electrical Incidents Required LEG-SCE-59-rev3. The Electrical Incident Occurrence Report Form will be used to submit reports to the Technical Administrator for the Electrical Discipline at safety.services@gov.ab.ca

These incidents must be reported:

- an accident to a person
- a fatal accident to livestock
- a power line contact involving an electrical installation or electrical equipment
- a fire of electrical origin

12.3.6 Reporting TDG incidents in Alberta

Any person who has the charge, management or control of a means of containment of dangerous goods that are being offered for transport, handled or transported by road vehicle, railway vehicle or ship shall report any actual or anticipated release of dangerous goods that is or could be in excess of a quantity or concentration specified in the regulations. Refer to Section 6.7 TDG and 6.7.8 TDG Reporting Quantities Table.

If an “emergency report” (i.e. a release or anticipated release of dangerous goods that are or could be in excess of reporting quantities) report as soon as possible to:

- Local authority responsible for emergency response
- 911 (or local police; relevant provincial authorities)
- Alberta Transportation 1-800-272-9600

Emergencies must be reported immediately:

- If there is a spill or leak exceeding the amount shown in the reporting quantities table; or
- If there could be a spill or leak exceeding the amount shown in the reporting quantities table; or
- If certain dangerous goods are lost or stolen; or
- If certain dangerous goods are interfered with.

In addition, if the incident involves:

- Death or injury requiring medical treatment;
- Evacuation or shelter-in-place of people;
- Closure of a loading/unloading facility;
- Closure of a road, rail line or waterway; or
- Major damage to the means of containment.

Then the emergency must ALSO be reported to CANUTEC (Canadian Transport Emergency Centre) and the consignor must be called.

If radioactive materials (Class 7) are involved, contact the Canadian Nuclear Safety Commission.

12.3.7 BC OHS

The following incidents must be immediately reported:

- Serious injury to or death of a worker
- Major structural failure or collapse of a building, bridge, tower, crane, hoist, temporary construction support system, or excavation
- Major release of a hazardous substance
- Blasting incident causing personal injury
- Dangerous incident involving explosives (whether or not there is personal injury)
- Diving incident

The following reportable injuries/illness must be reported within 3 days:

- The worker loses consciousness following the injury

- The worker is transported or directed by a first aid attendant or other employer representative to a hospital or other place of medical treatment, or is recommended by such persons to go to such place
- The injury is one that obviously requires medical treatment
- The worker has received medical treatment for the injury
- The worker is unable or claims to be unable by reason of the injury to return to his or her usual job function on any working day subsequent to the day of injury
- The injury or accident resulted or is claimed to have resulted in the breakage of an artificial member, eyeglasses, dentures or a hearing aid
- Worker or WorkSafeBC requested that an employer's report be sent.

Immediately report fatalities or serious injuries to the Emergency and Accident Reporting Line 1-888-621-7233. After initial notification, incidents can be reported online. Visit worksafebc.com and select “Report injury or illness.”

Incidents requiring immediate notification as well as any incidents that resulted in injury to a worker requiring medical treatment or those that had the potential for causing serious injury to a worker must be investigated. An interim investigation and report must be completed with 48 hours of the incident and a full investigation and report completed and submitted to the Worker’s Compensation Board within 30 days of the incident.

12.3.8 BC Oil and Gas Commission (OGC)

The following incidents must be immediately reported to the OGC:

- Matrix score of 3-8 (Level 1, 2 or 3 Emergency) as identified by the OGC Incident Classification Matrix.
- All spills identified below:
  - spill or release of any amount of materials which impacts water ways
  - produced/salt water; 200 L where the fluid contains no toxic materials
  - fresh water; 10,000 L
  - drilling or invert mud; 100 L
  - any fluid including hydrocarbons, drilling fluids, invert mud, effluent, emulsions, etc. which contain toxic substances; 25 L
  - spills or releases of hazardous substances which are not provincially regulated, such as radioactive substances
  - major damage to oil and gas roads or road structures

There are some incidents that may not meet the criteria outlined in the Incident Classification Matrix but still require notification to OGC as a “minor notification” including the following:

- Spills or release of hazardous substances which are not provincially regulated, such as radioactive substances;
- Major damage to oil and gas roads or road structures;

- Drilling kicks when any one of the following occur:
  - pit gain of 3m3 or greater
  - casing pressure 85% of MA
  - 50% out of hole when kicked
  - well taking fluid (LC)
  - associated spill
  - general situation deterioration, i.e. leaks, equipment failure, unable to circulate, etc.
- Pipeline incidents, such as spills during construction phase, near misses from mobile or excavation equipment, exposed pipe cause by flooding, pipeline over pressure, failure (without release) of any pressure control or ESD device;
- Induced seismicity >4 on the Richter scale during oil and gas operations such as well fracturing; and
- Security related issues which are relatively minor, such information may be required for tracking and monitoring purposes only.

The OGC reporting procedures are as follows (refer to the Corporate ERP for more information):

- OGC uses a “Incident Classification Matrix” to assist industry in determining which incidents must be reported.
- A matrix score of 3-8 (Level 1, 2 or 3 Emergency) must be reported within 1 hour of the incident to EMBC at 1-800-663-3456.
- A matrix score of 1-2 (minor incident) relating to a leak or spill must also be reported to EMBC at 1-800-663-3456 at the time of the incident (a DGIR# will be assigned). Then the minor incident can be entered into the Online Minor Incident Reporting system within 24 hours of the incident.
- A matrix score of 1-2 (minor incident) not relating to a spill or leak can be entered via the Online Minor Incident Reporting System within 24 hours of the incident.

12.3.9 Reporting TDG incidents in BC

In BC, in addition to federal TDG reporting requirements, the following substances are reportable as per the Hazardous Waste Regulations. Incidents must be immediately reported to EMBC at 1-800-663-3456.

Substance Spilled	Reportable Level
Class 1 Explosives	50kg; or any quantity that could pose a danger to public safety
Class 2.1 Flammable Gases (other than natural gas)	10 kg
Class 2.2 Non-Flammable, Non-Toxic Gases	10 kg
Class 2.3 Toxic Gases	5 kg
Class 4 Flammable Solids	25 kg
Class 5.1 Oxidizing Substances	50kg or 50L
Class 5.2 Organic Peroxides	1 kg or 1L
Class 6.1 Toxic Substances	5 kg or 5 L

Class 6.2 Infectious Substances	1 kg or 1 L; or less if the waste poses a danger to public safety or the environment
Class 7 Radioactive Materials	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
Class 8 Corrosives	5 kg or 5 L
Class 9 Miscellaneous Products, Substances, or Organisms	25 kg or 25 L
Waste containing dioxin	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
Leachable toxic waste	25 kg or 25 L
Waste containing polycyclic aromatic hydrocarbons	5 kg or 5 L
Waste asbestos	50 kg
Waste oil	100 L
Waste containing a pest control product	5 kg or 5 L
PCB wastes	25 kg or 25 L
Waste containing tetrachloroethylene	50 kg or 50 L
Biomedical waste	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
A hazardous waste	25 kg or 25 L
A substance not otherwise covered that can cause pollution.	200 kg or 200 L
Natural gas	10 kg; if there is a breakage in a pipeline or fitting operated above 100psi that results in a sudden discharge

12.3.10 Technical Safety BC (regarding Boilers, Pressure Vessels, Piping and Fittings)

Incidents must be reported that involve a failure of a regulated product, work or operation that causes:

- Damage to property, personal injury or death
- Damage to safety features.

Incidents and hazards are to be reported to BC Safety Authority online at https://portal.technicalsafetybc.ca/report-incident or by calling 1-866-566-7233.

12.4 Pieridae Internal Incident Reporting Requirements

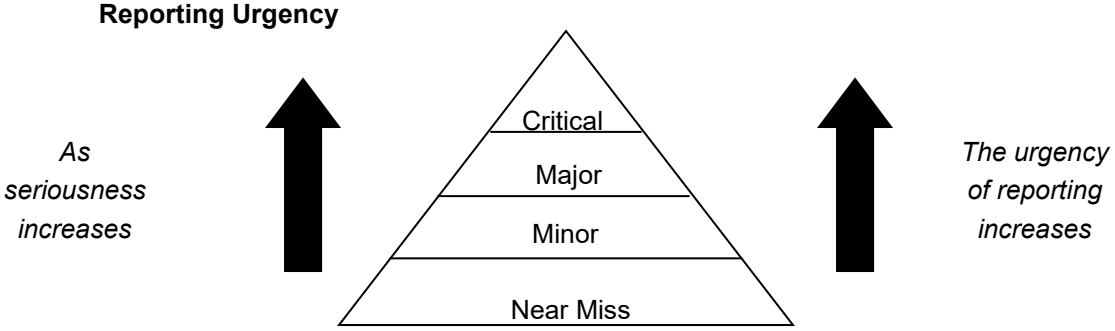
Pieridae requires that, in addition to the regulatory reporting requirements, the following incidents be reported internally. All incidents, including:

- Where only first aid may be required, but the incident could have resulted in serious injury;
- Where medical treatment is required,
- Every close call (or near miss) with the potential for serious injury or property loss exists;
  - Refer to Section 6.1.8 Hazard Alert/Near Miss Reporting.
- Any occurrence of fire or the discharge of a fire extinguisher; and
- Incidents resulting in damage to property, equipment, machinery or materials.

The corporate ERP will be used as a guide to define responsibilities when handling an incident. Refer to Section 11.0 Corporate Emergency Response Plan.

In general, the emergency reporting sequence will remain the same regardless of the type of incident. The only thing that will change is the immediacy of reporting and involvement of additional staff. In general, as the incident type moves up the incident reporting triangle, the urgency of reporting increases.

Reporting Urgency



Depending on the nature of the incident, various individuals within the company will assume specific responsibilities under the corporate emergency response plan. It is imperative that Pieridae employees and contractors unite as a team to effectively handle incidents and emergency situations. In no case will it be necessary for one person to handle all aspects of an emergency situation. It is important to use the expertise and manpower available within the company and obtain external expertise if required.

Pieridae Incident Reporting Requirements

Incident Type	Reporting Urgency
Near Miss	Fill out Hazard Alert / Near Miss card. Discuss with co-workers as soon as possible and send form to supervisor for discussion at safety meeting.
Minor	Contact supervisor. Fill out Incident Report form and send to supervisor. The supervisor will review, sign and then send the report to the Calgary office for further review.
Major	Contact supervisor. Supervisor will contact Calgary office staff as soon as possible. Fill out Incident Report form and send to supervisor. The supervisor will review, sign and send to the Calgary office for further review.
Critical	Immediately contact supervisor. Supervisor will immediately contact Calgary office. Calgary office will immediately contact the Board of Directors. Fill out Incident Report form and send to supervisor. The supervisor will review, sign and send to the Calgary office for further review.

Incident reports are used to alert and notify management about the circumstances surrounding an event. The report starts the process of written notification and facilitates communication. The report is intended to clearly document "what happened". Refer to Appendix 1, Form 11a – Incident Report.

It is the responsibility of the first person on the scene and/or the person who is directly involved with the incident to report the incident to the supervisor. If in doubt regarding the requirement to report, contact the supervisor for guidance. The person reporting the incident must complete the necessary incident report within 24 hours of the incident (or sooner if the situation dictates).

The following steps should be followed:

- Fill out the incident report.
- Send a copy to the supervisor for review and sign-off.
- The supervisor will review and then send a copy to the Calgary office (to the applicable manager and also to the HSE Coordinator).
- A decision will be made whether to investigate the incident.
- Certain incidents must be reported by management to senior management and/or the HSE Committee of the Board of Directors.
- The signed incident report will be filed in the HSE filing system and the appropriate well file or facility file.
- If the incident affects landowners (e.g. offsite spill) a copy of the report should also be

sent to the Surface Land department for review and follow up.

- Depending on the nature of the incident, internal reports or additional regulatory reports may be required (e.g. reportable spills, workplace injuries).
- Incident reports will be summarized in the HSE Report.
- Incident statistics will be reported internally and externally, as required (e.g. Canadian Association of Petroleum Producers as per the Responsible Canadian Energy program).

12.5 Incident Investigation Reporting Requirements

The purpose of incident investigation is to determine the underlying causes of incidents and to recommend corrective actions to eliminate or minimize these events. Refer to Appendix 1, Form 11b – Investigation Report.

The responsibility for the completion of an investigation report will be determined based on the nature of the incident. In many cases, the supervisor will complete the investigation. However, there may be certain major or critical incidents that require an investigation team to complete the necessary components (i.e. engineering, manufacturers, operations etc.).

The investigation report should be completed within 72 hours of the incident (or sooner if the situation dictates). Circumstances that require forensic engineering or regulatory investigation may take longer to complete. The investigation report is an internal company document and will be retained on file. Once the investigation report is complete it must be filed with the related incident report and a copy should also be sent back to the individual who originally reported the incident.

Except as otherwise directed by a Director of Inspection (i.e. under the provincial OHS Act), an OHS Officer or a peace officer, do not disturb the scene of an OHS reportable incident except as necessary in:

- attending to persons injured or killed;
- preventing further injuries; and
- protecting property that is endangered as a result of the incident.

In the case of an Alberta Occupational Health and Safety reportable incident an government officer may request to see company reports. Reports must be kept on file for a period of two years following an OHS reportable accident.

12.6 Witness Accounts

Although there may be occasions when witness accounts are unavailable, wherever possible effort should be made to interview witnesses or collect witness statements. Refer to Appendix 1, Form 11e – Witness Statement.

In some situations, witnesses may be the primary source of information because investigation may be required without being able to examine the scene immediately after the event. Because witnesses may be under severe emotional stress or afraid to be completely open for fear of recrimination, interviewing witnesses is a difficult task for an investigator.

Witnesses should be kept apart and interviewed as soon as possible after the incident. If witnesses have an opportunity to discuss the event among themselves, individual perceptions may be lost in the normal process of accepting a consensus view where doubt exists about the facts.

Witnesses should be interviewed alone, rather than in a group. Interview a witness at the scene where it is easier to establish the positions of each person involved and to obtain a description of the events. There may be occasions where it is preferable to carry out interviews in a quiet office where there will be fewer distractions. The decision may depend in part on the nature of the incident and the mental state of the witnesses.

When interviewing, as open-ended questions that cannot be simply answer by “yes”, or “no”. The questions will vary with each incident, but there are some general questions that should be asked each time:

- Where were you at the time of the incident?
- What were you doing at the time?
- What did you see, hear?
- What were the work environment conditions (weather, light, noise, etc.) at the time?
- What was (were) the injured worker(s) doing at the time?
- In your opinion, what caused the incident?
- How might similar incidents be prevented in the future?

Asking questions is a straightforward approach to establishing what happened. But, care must be taken to assess the accuracy of any statements made in the interviews.

Another technique sometimes used to determine the sequence of events is to re-enact or replay them as they happened. Care must be taken so that further injury or damage does not occur. A witness (usually the injured worker) is asked to re-enact in slow motion the actions that happened before the incident.

12.7 Investigation Procedures

When an incident occurs, an investigation should be conducted. Incident investigation and follow-up help to determine why incidents occurred and aid in preventing reoccurrence. It is important to follow-up on incidents to ensure “closure”. The purpose of investigation is to identify the factors that contributed to the event and the causes behind those factors.

Individuals that investigate incidents should be trained and familiar with the situation. Refer to Section 4.6.3 Incident Investigation.

The investigation form should guide the investigators regarding the types of information that needs to be collected. Refer to Appendix 1, Form 11b Investigation Report. However, depending on the nature of the incident more information may be required. In general, the following steps should be followed during an investigation:

Conduct Initial Walk-through

- Do not disturb the scene if regulatory authorities are investigating.
- Observe conditions.

Gather Information

- Position: sketch, map, diagram, photograph and/or use camcorder.
- People: interview eyewitnesses (other witnesses may be interviewed later).
- Parts (physical evidence): “bag and tag” relevant evidence.
- Paper (records and other documents): chronologically document the events leading up to and following the incident.

Analyze Information

- List the events in the order in which they occurred.
- Identify the immediate causes.
- Identify the root cause (in particular as it relates to pipeline and/or pressure equipment failures).

Develop Corrective Actions

- Identify actions to address the immediate causes.
- Identify long-term corrective actions to eliminate root causes.

12.8 Root Cause Analysis

Pieridae will endeavor to identify the root cause of all incidents. However, seldom, if ever, is there only a single cause. Therefore, it is useful to examine all underlying factors in a chain of events that ends in an incident. It is important to involve a supervisor who knows the most about the work and conditions with the investigation. All incident reports and investigations are reviewed by a team to review findings and recommendations thoroughly.

There are various causation models that can be used (Heinrich’s domino theory, swiss cheese theory, taproot theory, and MORT (management oversight and risk tree), “5 whys” method, SCAT, etc). Root cause analysis is often used in proactive incident management to identify the root cause of the incident or the main cause of the incident. A factor is considered the root cause of an incident if removing it prevents the incident from recurring. Conversely, a causal factor is one that affects an event’s outcome but is not the root cause.

Although removing a causal factor can benefit an outcome, it does not prevent its recurrence with certainty.

For example, the MORT model attempts to illustrate that the causes of any incident can be grouped into five categories: task, material, environment, personnel, management. This model has been simplified here to provide guidance for uncovering all possible causes and reduces the likelihood of looking at facts in isolation.

Task

Here the actual work procedure being used at the time of the incident is explored. Members of the investigation team will look for answers to questions such as:

- Was a safe work procedure used?
- Had conditions changed to make the normal procedure unsafe?
- Were the appropriate tools and materials available?
- Were they used?
- Were safety devices working properly?
- Was lockout used when necessary?

For most of these questions, an important follow-up question is "If not, why not?"

Material

To seek out possible causes resulting from the equipment and materials used, investigators might ask:

- Was there an equipment failure?
- What caused it to fail?
- Was the machinery poorly designed?
- Were hazardous products involved?
- Were they clearly identified?
- Was a less hazardous alternative product possible and available?
- Was the raw material substandard in some way?
- Should personal protective equipment (PPE) have been used?
- Was the PPE used?
- Were users of PPE properly educated and trained?

Each time the answer reveals an unsafe condition, the investigator must ask why this situation was allowed to exist.

Work Environment

The physical work environment, and especially sudden changes to that environment, are factors that need to be identified. The situation at the time of the incident is what is important, not what the "usual" conditions were. For example, investigators may want to know:

- What were the weather conditions?
- Was poor housekeeping a problem?
- Was it too hot or too cold?
- Was noise a problem?
- Was there adequate light?
- Were toxic or hazardous gases, dusts, or fumes present?

Personnel

The physical and mental condition of those individuals directly involved in the event must be explored, as well as the psychosocial environment they were working within. The purpose for investigating the incident is not to establish blame against someone but the inquiry will not be complete unless personal characteristics or psychosocial factors are considered. Some factors will remain essentially constant while others may vary from day to day:

- Did the worker follow the safe operating procedures?
- Were workers experienced in the work being done?
- Had they been adequately educated and trained?
- Can they physically do the work?
- What was the status of their health?
- Were they tired?
- Was fatigue or shiftwork an issue?
- Were they under stress (work or personal)?
- Was there pressure to complete tasks under a deadline, or to by-pass safety procedures?

Management

Management holds the legal responsibility for the safety of the workplace and therefore the role of supervisors and higher management and the role or presence of management systems must always be considered in an incident investigation. These factors may also

be called organizational factors. Failures of management systems are often found to be direct or indirect causes. Ask questions such as:

- Were safety rules or safe work procedures communicated to and understood by all employees?
- Were written procedures and orientation available?
- Were the safe work procedures being enforced?
- Was there adequate supervision?
- Were workers educated and trained to do the work?
- Had hazards and risks been previously identified and assessed?
- Had procedures been developed to eliminate the hazards or control the risks?
- Were unsafe conditions corrected?
- Was regular maintenance of equipment carried out?
- Were regular safety inspections carried out?
- Had the condition or concern been reported beforehand?
- Was action taken?

12.9 Trending and Analysis

The review of trends with incident reporting is a key activity that is used to help prevent the occurrence and reoccurrence of incidents. Pieridae is committed to preventing future incidents through trending and analysis of incidents and learning from near misses and incidents.

Key metrics are also set annually and are approved by management and the HSE and Reserves Committee of the Board of Directors. These metrics include operational activities and are scored annually. Incidents are reviewed locally (where the incident occurred), are summarized in the monthly HSE Report, and are reviewed and statistically analyzed at quarterly HSEC meetings. Incident statistics and a summary is also reported to the Board of Director's quarterly.

Incidence rate will be calculated quarterly. Pieridae will calculate TRIF for comparison amongst our peer group using the incidence reporting metrics outlined in the CAPP Health and Safety Performance Metrics Reporting guideline.

TRIF = (# of recordable incidents x 200,000 hours) / total hours worked

12.10 Types of Incident Reporting Forms

All forms are contained in the Appendix 1 – Forms and are also available electronically.

Form 09 - Hazard Alert / Near Miss Report

- This report is in the form of a handy half-page format. The form is intended to be used to report hazards and near misses and includes hazard identification, cause and corrective actions taken.

Form 11a - Incident Report

- This is the first form that should be filled out if there is an incident. It is a one page form that captures relevant information regarding date, time, location, description and events leading up to the event and a summary of the incident. The report should be filled out by the Pieridae work site supervisor. This form will direct personnel to additional forms if required (i.e. spill/release report, vehicle accident, investigation reports or WCB). The report also documents immediate corrective actions taken.

Form 11b - Investigation Report

- This form is completed for incidents that require additional investigation due to internal and/or regulatory requirements and includes a summary of events immediately preceding the incident, a summary of the actual event, and the actual or suspected cause and the rationale used to determine the cause. The form also documents notifications, corrective actions/recommendations, cost estimate, and emergency response plan evaluation.

Form 11c - Vehicle Accident Report

- This is a two page form that captures vehicle incident details to satisfy insurance requirements and information that will be required in the event of a police report. The form is a supplement to the Incident Report.

Form 11d - Spill/Release Report

- This is a one page form that captures detailed information to satisfy specific regulatory reporting requirements. The form is a supplement to the Incident Report. This report may be faxed to the regulators and/or used to provide information of regulatory reports.

Worker's Compensation Board (WCB) Forms

- These forms are standard as provided by the Workers' Compensation Board (WCB) and are available from the Pieridae Calgary office or the WCB web site. There are three forms:
  - Worker's Report of Injury or Occupational Disease,
  - Employer's Report of Injury or Occupational Disease, and
  - Automobile Accident Report.
- WCB covers work-related injuries or diseases that cause medical aid or time away from work beyond the day of the injury.
- In the event of injury or occupational disease, a WCB Employer's Report of Injury or Occupational Disease must be completed and submitted within 72 hours of the

incident.

- The Employee's Report of Injury or Occupational Disease must also be submitted to the WCB as soon as the employee is able to report. Please note that it is in the best interest of the injured worker to submit a form so that it is on record with the WCB in the event of future complications (i.e. for the protection of the worker).

Section 13.0

Table of Contents

13.0 DRILLING AND COMPLETION GUIDELINES

13.1 Introduction

Pieridae will conduct all drilling, completions and workover operations in compliance with regulatory requirements. The purpose of this procedure is to establish Pieridae's expectations with respect to communication and to outline responsibilities of the wellsite supervisor. Any conflict regarding safe working procedures shall be discussed by the wellsite supervisor and the contractor representative and the regulatory requirements will prevail.

The following documents were used to develop this procedure:

- AER Directive 36: Drilling Blowout Prevention Requirements and Procedures;
- AER Directive 37: Service Rig Inspection Manual;
- Alberta Occupational Health and Safety Regulation and Code, including Part 37 Oil and Gas Wells; and
- Industry Recommended Practice (IRP) Volume 7 (2008 version) Standards for Wellsite Supervision of Drilling, Completion and Workovers.

The AER expects the Pieridae representative (i.e. wellsite supervisor) and contractor representatives (drilling/servicing contractor) to understand, respect, meet and/or exceed the AER's regulations and requirements. Pieridae will accomplish this by:

- Providing a corporate policy and procedures regarding drilling, completions and workovers;
- Conducting inspections as required;
- Monitoring the AER inspection record and taking appropriate action where necessary;
- Ensuring wellsite personnel have the required training;
- Informing wellsite personnel of potential hole problems, sensitive environmental concerns, and public issues, in order to ensure that all appropriate action plans are implemented; and
- Cooperating with the AER, government and public by open communication to address areas of mutual concern.

13.2 Definitions

The following definitions were taken from IRP Volume 7 and apply to the Section 13.0 Drilling and Completions of the Pieridae HSE Program.

- **Prime Contractor**: When workers from more than one employer are working at a wellsite then one party must have overall responsibility for safety at that wellsite and coordination of all employers to carry out the planned work. In Alberta this party is known as the "prime contractor". In other jurisdictions this specific term may not be used, but the legislation has similar requirements and responsibilities for this function.

- **Operator:** The owner of the wellsite is the prime contractor unless it has specifically assigned this responsibility to another party by written agreement and has taken steps to ensure that the party is capable of fulfilling all the duties and responsibilities required of a prime contractor. When a well has more than one owner, the owner who is assigned as the operator has the responsibilities of prime contractor. Generally, this is the licensee of the well.
- **Wellsite Supervisor:** The term wellsite supervisor is commonly used to describe the individual who is representing the operator or prime contractor at the wellsite and is generally responsible for directing all employers at the wellsite. The wellsite supervisor is therefore the representative of the prime contractor at the wellsite. Other commonly used terms for this person are “consultant”, “company man” and “engineer” (the use of “engineer” must be avoided unless the individual is a registered P.Eng.).
- **Employer:** In this document this term means any company that has one or more employees at the wellsite. This includes “drilling contractors” and “service companies” or “sub-contractors” commonly referred to in the industry. It also includes any small contractors or businesses that have one or more people doing work at the wellsite whether they are employees, owner operators or self employed workers.
- **Employer’s Supervisor:** In OHS legislation it is a general requirement that employers provide their workers with adequate training and supervision. There are various detailed requirements that help define what constitutes adequate supervision and a competent supervisor. The term “employer’s supervisor” refers to the person directly responsible for the supervision of the work and workers for a specific employer at the worksite. Examples of an employer’s supervisor are: rig manager, driller, truck push, frac crew supervisor, logging supervisor, drill stem tester, power tong operator, cementing supervisor.

13.3 Wellsite Supervisor - Safety Management

In terms of safety management, the duties of the wellsite supervisor, as the representative of the prime contractor (Pieridae), should include the following:

- Identify themselves at the wellsite and ensure they can be easily located and contacted at all times. An alternate competent representative of the prime contractor must also be identified who can be contacted if the wellsite supervisor becomes incapacitated or inaccessible for any reason.
- Check that all employers on the wellsite have an effective safety program and safe work procedures.
- Check that all employers understand and agree to follow all requirements of the prime contractor’s safety program that are not already met by their own safety program.
- Provide for wellsite orientation of all employers and visitors on arrival at the wellsite.
- Coordinate the efforts of all employers at the wellsite. Resolve any discrepancies between safe work procedures before starting the work.

- Identify and document the name of the onsite supervisor for each employer prior to starting any work.
- Review and clarify the roles and responsibilities of all employers and onsite supervisors prior to doing any work.
- Check that all employers onsite are providing their employees with the training and supervision described in Section 13.4 Other Onsite Employer's – Safety Management.
- Ascertain the number of inexperienced workers and review job execution plans with the employer to ensure these workers receive adequate supervision.
- Identify hazards related to the specific wellsite, the planned program or the materials provided by the prime contractor. Inform all employers of these hazards and ensure proper controls are in place before the work begins.
- Establish and coordinate site specific emergency response procedures. Post information, review procedures and conduct practice drills with personnel onsite.
- Ensure that well control and blowout prevention measures meet regulations.
- Monitor the work performed by all employers to verify compliance with safety legislation as well as safety program requirements.
- Monitor the wellsite for proper use, handling, storage and maintenance of personal protective equipment by all workers.
- Check that the procedures for handling, transportation, disposal, storage and use of all hazardous substances, follows applicable regulations and safe practices.
- Implement detection and control of hydrogen sulfide and other hazardous gases to prevent harmful exposure of workers or the public.
- Implement detection and control of any flammable substances that may be emitted from the well or surface facilities, to prevent accidental fire or explosion.
- Direct work to be stopped when an unsafe act or condition is identified. Resume work only after the hazard is removed or safe procedures have been established. Refer to Section 6.1 Hazard Identification and Control.
- Ensure incidents are near misses are reported and investigated. Refer to Section 12.0 Incident Reporting and Investigation.

13.4 Communication

Effective communication is an instrumental component of the HSE Program. Pieridae employees and wellsite supervisors will utilize and reference the HSE Program and will follow safe work procedures thereby promoting a safe and healthy workplace.

13.4.1 Work Site Supervisor HSE Packages

Project consultants (construction, drilling, and completion) will receive an HSE package at the beginning of each new project. The package is designed to facilitate implementation of the HSE program by consultants that work for Pieridae in the capacity of work site supervisor. The package includes Pieridae's HSE Program, instructions on use of relevant procedures and forms, emergency contact information, and site supervisor training requirements. Once a project is complete, the package will be sent to the Calgary office for review and file.

13.4.2 Drilling and Completions Programs

Drilling and completions programs are prepared by the Calgary office and are sent to the wellsite supervisor prior to beginning an operation.

The drilling and completion program must be reviewed for specific safety requirements and responsibilities.

The drilling and completions programs should include the following:

- License;
- Survey;
- Surface land approvals;
- Operations summary;
- STICK diagram (will also be posted in the doghouse);
- Instructions to conduct rig Inspections and BOP testing as per regulatory requirements;
- Instructions to prepare a site specific emergency phone list;
- A Specific ERP (if required); and
- Safety overview.

13.4.3 Supervisory Control

Refer to HSE Program, Section 6.3 Supervisory Control.

13.4.4 Work Clearance and Notifications

Simultaneous operations or "SIMOPS" occurs when there is more than one operation or activity being conducted at a site at one time. Refer to Section 6.3.2 SIMOPS and Appendix 1, Form 18a Simultaneous Operations (SIMOPS).

13.4.5 Drilling and Completion Site Safety Assessments

Drilling and completion operations have unique requirements and as such hazard identification and control is addressed via task/work specific contractor hazard analysis documentation.

13.4.6 Fire and Explosion Prevention Plan

A site-specific fire and explosion prevention plan should be considered for all completion operations. Refer to Section 9.7 Fire and Explosion Hazard Management and Appendix 1, Form 07 – Fire and Explosion Prevention Plan. The use of an equivalent contractor form is permitted.

As a minimum, a fire and explosion prevention plan is required where oxygen-air or oxidizing chemicals are purposely used or inadvertently introduced in well drilling and servicing operations, for all snubbing applications, and for all well workover applications using hydrocarbon-based fluids.

13.4.7 Safety Meetings

It is the expectation that a safety meeting will be held each day before work begins and/or before hazardous work begins. In many cases the drilling or servicing contractor will host and document the meeting. If this is the case the wellsite supervisor must note the meeting on the daily report to the Calgary office. If the contractor does not conduct a meeting then the wellsite supervisor can initiate the meeting and document same on the Pre-Job Safety Meeting Form. The meeting should be attended by all workers on a work site before work begins.

This is an opportunity to ensure that the Drilling and Completions Site Safety Assessment remains valid; any new workers receive an orientation; any new hazards are identified; and Pieridae's commitment to working safely is emphasized.

13.4.8 Incident Reporting and Investigation

Incidents must be reported verbally to the Calgary office supervisor and a written incident report must be completed within 24 hours and an investigation report completed within 72 hours (or sooner). Contractor incident reports should also be collected. Refer to Section 12.0 Incident Reporting and Investigation for additional information and Section 11.0 Corporate Emergency Response Plan.

13.5 Wellsite Supervisor Responsibilities

During any drilling, completion or workover the wellsite supervisor is the Pieridae representative and shall administer the Pieridae HSE Program policies and procedures and will be held responsible for coordinating activities with all the sub-contractor's supervisors. The wellsite supervisor shall ensure that the rig crews and all service personnel follow OHS and other applicable regulations as they pertain to the job. The wellsite supervisor is responsible for wellsite operations and is the primary liaison between the Pieridae Calgary office and field operations.

13.5.1 AER Requirements for Wellsite Supervision

For all wells being drilled, completed or worked over, Pieridae will provide the following:

- A wellsite supervisor (not the rig manager) who is responsible for the supervision of the drilling operations; and
- A rig manager who is responsible for the supervision of the drilling or service rig.
- Both the wellsite supervisor and the rig manager will be readily available (within 2 hours) at all times.
- The wellsite supervisor and the rig manager cannot supervise other drilling/servicing operations at the same time.
- For critical sour wells, prior to penetrating and during the drilling of the critical sour zone, there will be a 24-hour onsite supervisor.
- When potential hydrocarbon-bearing zones have been penetrated, either the wellsite supervisor or the rig manager will be on site while tripping in or out of the well. If it becomes necessary to make an unscheduled trip when neither of these individuals is present, the trip may commence immediately after contacting the wellsite supervisor or rig manager. The wellsite supervisor or rig manager will then return to the well immediately.

13.5.2 AER Training Requirements for Drilling Operations

- The wellsite supervisor, rig manager and driller will be trained and certified by Energy Safety Canada (previously Enform) in the operation of blowout prevention equipment and well control.
- The wellsite supervisor and rig manager will possess a valid Second-Line Supervisor's Well Control Certificate issued by Energy Safety Canada (previously Enform). Certificates expire on the date recorded on the certificate.
- The driller will possess either a valid First-Line Supervisor's Blowout Prevention Certificate or a Second-Line Well Control Certificate issued by Energy Safety Canada (previously Enform). Certificates expire on the date recorded on the certificate.
- If the driller does not possess a valid certificate, the drilling operations will be suspended (if safe to do so). Operations will not be allowed to resume until the driller is replaced with a qualified individual. The AER may allow the rig manager to temporarily replace the driller and continue drilling operations (if safe to do so), providing that the replacement is on route (available within 2 hours).
- If any of the above individuals do not possess a valid Energy Safety Canada (previously Enform) certificate, the drilling operations will be suspended (if safe to do so). Operations will not be allowed to resume until such persons are replaced with qualified individuals. The AER may allow drilling operations to continue (if safe to do so), providing that the replacement individual(s) are en route (available within 2 hours).

13.5.3 Drilling and Completions Training Requirements

The following table has been excerpted from IRP Volume 7 and adopted by Pieridae as the training standard for wellsite supervisors and those persons directing wellsite supervisors.

Course	Renewal Frequency (years)	Drilling Supervisor	Completions / Workover Supervisor	Person Directing Wellsite Supervisor
Safety Management and Regulatory Awareness for Wellsite Supervisors	3	Yes	Yes	Yes
Second Line Supervisor's Well Control	2	Yes	No	Yes for drilling
Well Service Blowout Prevention	5	No	Yes	Yes for completions and servicing
Detection and Control of Flammable Substances	3	Optional	Yes	Optional
WHMIS	3	Yes	Yes	Yes
Standard First Aid	3	Yes	Yes	Optional
TDG	3	Yes	Yes	Yes
H2S Alive	3	Yes	Yes	Yes

13.6 AER Requirements

Pieridae's policy is for Wellsite Supervisors to follow AER regulatory requirements. Specific regulations and requirements should be available to the Wellsite Supervisors onsite either in hardcopy or via the internet. The following list of documents must be available:

- AER Directive 36: Drilling Blowout Prevention Requirements and Procedures;
- AER Directive 37: Service Rig Inspection Manual;
- Alberta Occupational Health and Safety Regulation and Code, including Part 37 Oil and Gas Wells; and
- IRP Volume 7 – 2002 Standards for Wellsite Supervision of Drilling, Completion and Workovers.

13.7 Industry Recommended Practices (IRPs)

Industry recommended practices are produced by a consortium of industry, contractors and government and should be used as a reference to guide field operations. IRPs are a set of best practices and guidelines, compiled by knowledgeable and experienced industry and government personnel and are intended to provide advice.

The following Drilling and Completion Committee (DACC) IRPs are available on the Energy Safety Canada website:

- DACC IRP Volume #01 – Critical Sour Drilling
- DACC IRP Volume #02 – Completing and Servicing Critical Sour Wells
- DACC IRP Volume #03 – In Situ Heavy Oil Operations
- DACC IRP Volume #04 – Well Testing and Fluid Handling
- DACC IRP Volume #05 – Minimum Wellhead Requirements
- DACC IRP Volume #06 – Critical Sour Underbalanced Drilling
- DACC IRP Volume #07 – Standards for Wellsite Supervision of Drilling, Completion and Workovers (including the 2019 release)
- DACC IRP Volume #08 – Pumping of Flammable Fluids (2016)
- DACC IRP Volume #13 – Slickline Operations
- DACC IRP Volume #14 – Non-Water Based Drilling Fluids
- DACC IRP Volume #15 – Snubbing Operations
- DACC IRP Volume #20 – Wellsite Design Spacing Recommendations
- DACC IRP Volume #21 – Coiled Tubing Operations
- DACC IRP Volume #22 – Underbalanced and Managed Pressure Drilling Operations Using Jointed Pipe
- DACC IRP Volume #24 – Fracture Stimulation
- DACC IRP Volume #25 – Primary Cementing

13.8 General Safety Precautions

- Follow all applicable regulations and requirements.
- Follow Pieridae's HSE Program.
- Follow the drilling or service rig contractor's specific procedures for the rig (as supervised and coordinated by the Rig Manager).
- Personnel shall use required safety devices, safeguards and personal protective equipment.
- The rig floor and BOPs will be kept clean, clear and ice free.
- Maintain appropriate distances from powerlines and electrical wires.

Appendix 1 – Forms

HSE Program Forms

- Form 01 – Backfill Inspection Report
- Form 02 – Blind List
- Form 03 – Confined Space Entry Permit
- Form 04 – Contractor's HSE Orientation
- Form 05 – Drilling & Completions Site Safety Assessment (Not in use.)
- Form 06 – Employee Orientation Checklist
- Form 07 – Fire and Explosion Prevention Plan
- Form 08 – Ground Disturbance Permit
- Form 09 – Hazard Alert/Near Miss Report
- Form 10 – HSE Assessment
- Form 11a – Incident Report
- Form 11b – Investigation Report
- Form 11c – Vehicle Accident Report
- Form 11d – Spill/Release Report
- Form 11e – Witness Statement
- Form 12 – Job Hazard Analysis
- Form 13 – Lock Out
- Form 14 – Management of Change Authorization (Refer to Other Manual.)
- Form 15 – Monthly HSE Inspection Checklist
- Form 16 – Pre-Job Safety Meeting Report
- Form 17 – Resident Flaring, Venting, Incineration Notification Form
- Form 18 – Safe Work Permit
- Form 18a – Simultaneous Operations Form
- Form 18b – Handover Form
- Form 19 – Safety Meeting Minutes
- Form 20 – Site Specific Procedure (template)
- Form 21 – Surface Water Runoff Release
- Form 22 – Watchman's Log
- Form 23 – Vehicle Inspection Checklist

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Form – 01

Backfill Inspection Report

PROJECT: _____

LOCATION: LSD_____ SEC_____ TWP_____ RGE_____ MER_____

Type of CROSSING: (Check one)

- ☐ Pipeline
  - ☐ oil ☐ gas ☐ water
- ☐ Co-op
  - ☐ gas ☐ water
- ☐ Watercourse
  - ☐ river ☐ creek/stream ☐ drainage ☐ lake ☐ slough
- ☐ Road
  - ☐ trail ☐ gravel ☐ paved
- ☐ Railway
- ☐ Telecommunications Cable
- ☐ Other (specify):_____

EXISTING FACILITY INFORMATION:

Name of existing facility owner: _____

Crossing Agreement Number:_____

NEW INSTALLATION (FACILITY) INFORMATION:

Contractor:_____

Type of Line: _____

Size of Line: _____

WT: _____

Material: _____

Coated? Type? _____

Cathodic Protection? Yes ☐ No ☐ N/A ☐

Was there any damage to the existing facility during exposure/installation of the new line? Yes ☐ No ☐

If yes, explain: _____

_____

_____

Were the owner and the regulator (AER) notified of the damage?

Yes ☐ No ☐

If no, ensure both parties are notified.

Describe repairs (if applicable):_____

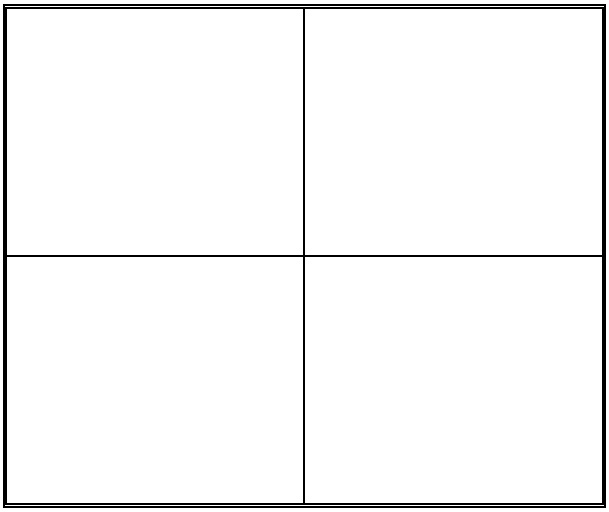
_____

_____

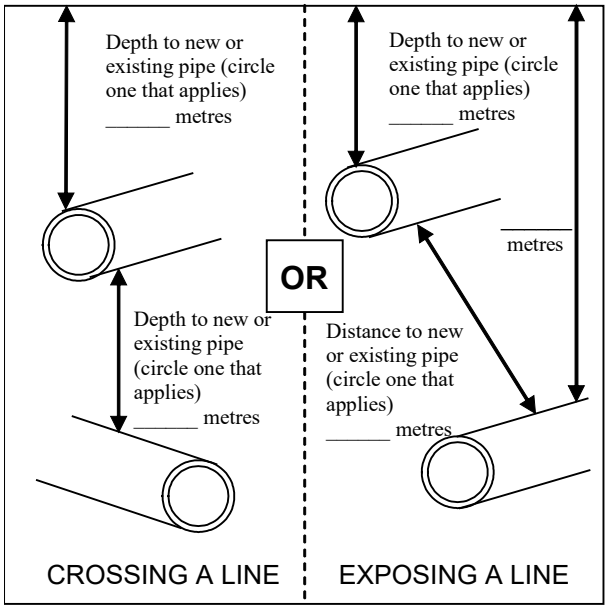
_____

On diagram below indicate:

1) All surface improvements (i.e. roads, railways, fences, etc.)
2) All land forms (i.e. rivers, lakes, forested areas)
3) Staging areas
4) Direction (North)



Ground Surface



Prepared by: (print)	Date Backfill Completed:	APPROVALS (Backfill Conditions Satisfactory) Owner:_____ Company Rep:_____

This report must be maintained on file for a minimum of two years.
Copy – Existing Facility Owner (if applicable)

PIERIDAE ENERGY

Form – 02

Blind List

Safe Work Permit (cross-reference):	
Work to be done:	

#	Size	Description	Isolated Position: Open/Closed	Lock	Tag

Isolated By (Operations):		
Name	Signature	Date

Isolated By (Contractor/Craftsman):		
Name	Signature	Date

Returned to Service By (Operations):		
Name	Signature	Date

Comments:

PIERIDAE ENERGY

Form – 03

Confined Space Entry Permit

General Information	Safe Work Permit (cross reference)	
	Facility Location:	
	Specific Location:	

Permit Validation	Permit Valid: (Date & Time)	From: To:	Work Site Supervisor:
	Permit Closed (Date & Time)	☐ Job Complete ☐ End of Shift ☐ Cancelled	Signature:

HAZARDS	
☐	Corrosive, toxic, oxygen deficient or flammable/explosive atmospheres, either as a normal characteristic of the space or because of the work being performed.
☐	Contaminants entering from other areas via ducts or piping.
☐	Temperature extremes (hot or cold).
☐	Electrical shock or ignition of flammable gases from portable lights, tools or associated electrical equipment.
☐	Injury from mechanical equipment.
☐	Abnormal weather conditions such as electrical storms or extreme inversions with no wind.
☐	Operation of equipment and/or work procedures.

PRE-JOB SAFETY MEETING	
☐	Pre-job safety meeting should address: planning, hazard review, roles and responsibilities, communication, training qualifications (including use, care fitting and maintenance of respiratory protective equipment), entry plan and rescue plan.

ENTRY AND RESCUE PLAN

Entry Plan (attach separate sheet if required):

Rescue Plan (attach separate sheet if required):

PIERIDAE ENERGY

Form 04

CONTRACTOR'S HSE ORIENTATION 2019-2020

At Pieridae Energy, we take the health, safety and security of our employees, contractors, customers and neighbours very seriously. We have a responsibility toward people and the environment.

Learn more at www.pieridaeenergy.com

Things to think about before starting work:

PIERIDAE ENERGY

Form 04

CONTRACTOR'S HSE ORIENTATION 2019-2020

At Pieridae Energy, we take the health, safety and security of our employees, contractors, customers and neighbours very seriously. We have a responsibility toward people and the environment.

Learn more at www.pieridaeenergy.com

1. Accountability/Responsibility

Pieridae - is responsible for promoting and maintaining safe and healthy workplaces and to protect all employees, contractors, the environment and the public. To achieve this, the following fundamental activities will be completed prior to commencing work on Pieridae work sites:

- Comply with applicable laws and regulations.
- Pieridae employees and/or work site supervisors will be familiar with and implement the HSE Program.
- For new contractors, a safety orientation will be conducted that will include the distribution of the Contractor's HSE Orientation pamphlet, the completion and collection of the acknowledgement form and issuance of a hard hat sticker.
- Ensure a safety meeting is conducted prior to beginning work.
- Issue a safe work permit prior to beginning work. Also refer to 4. Safe Work Permits.
- Monitor contractor progress and as a minimum will obtain verbal confirmation upon completion of a job.

Contractors - performing work for Pieridae are expected to perform activities in a safe and environmentally responsible manner in accordance with regulations. Contractors are responsible for the safety of its employees and subcontractors. Contractors will:

- Comply with applicable laws and regulations.
- Follow its own safe work procedures and Pieridae standard operating procedures communicated during orientation, safe work permitting and safety meetings.
- Provide trained and qualified personnel competent to complete the work.
- Provide HSE training for its employees and maintain records of training certification.
- Cooperate and communicate with Pieridae work site supervisor to safely complete the work.
- Report hazards and take steps to address unsafe conditions.
- Have the right and obligation to refuse to conduct unsafe work.

2. Arrive Ready for Work (Contractor Rules)

When working on Pieridae work sites, the following rules will be followed:

- Maintain provincial Worker's Compensation Board account in good standing.
- Maintain at least $2,000,000 comprehensive general liability insurance and $2,000,000 automobile liability insurance.
- Have a safety program that satisfies applicable government regulations.
- Provide equipment, including personal protective equipment (PPE), in compliance with applicable legislation and Canadian Standards Association (CSA) standards.
- Wear standard PPE on Pieridae work sites including: hard hat, steel-toed footwear, fire retardant clothing and safety glasses. When particular tasks require specific personal protective equipment such as hearing protection, respiratory protective equipment, fall protection equipment, combustible gas meters or personal monitors, the equipment must be provided, properly used and maintained by the contractor.
- Provide first aid training and equipment for its personnel as per regulatory requirements.
- Provide appropriate fire extinguishing equipment for its activities at the work site.
- Ensure hazardous products are properly labelled as per TDG and WHMIS and ensure applicable MSDS are available.
- Practice good housekeeping at the work site. Garbage and waste must be disposed of in appropriate containers and at approved facilities.
- Not allow alcoholic beverages, illegal drugs, cannabis/prescribed substances, firearms, weapons or explosives at Pieridae work sites. Persons under the influence of alcohol or drugs are not permitted on Pieridae work sites.
- Only allow smoking in designated areas.
- Prohibit horseplay, fighting or other disturbances.
- Report hazards, unsafe conditions or behaviours and incidents to the Pieridae work site supervisor.

3. Safety Meetings

It is the expectation that a safety meeting will be held each day and/or prior to hazardous activities before work begins.

4. Safe Work Permits

A safe work permit will be issued to the contractor by a Pieridae work site supervisor before work begins. The use of the safe work permit assists in determining hazards and the types of controls required to protect workers. The contractor will notify the permit issuer when the job is completed.

Drilling and completion operations have unique requirements and as such hazard identification and control is addressed via task/work specific contractor hazard analysis documentation.

5. Hazard Identification & Control

Every work site contains hazards that must be controlled to ensure worker safety. It is the joint

responsibility of the Pieridae work site supervisor and contractors to identify work site hazards and controls via safe work permits, safety meetings, and contractor field level hazard assessments. Communication is an integral and vital part of hazard identification and control. When in doubt – **STOP** – and ask the work site supervisor for further clarification.

Hazards may include: exposure to toxic atmospheres; flammable products; oxygen deficiency; rotating equipment; confined space; moving vehicles/equipment; high pressures; noise; excavations; extreme hot or cold temperatures; radioactive sources; overhead or underground pipelines and electrical lines; working at heights/falling; adequate lighting or working alone; etc. Hazard controls may include: substitution, elimination, engineering controls, administrative controls, and PPE (e.g. safety equipment; ventilation; isolation; atmospheric testing; etc.). WHMIS and TDG regulations govern information regarding hazardous substances. Refer to SDS sheets for specific information.

6. Training

Contractors will provide trained and qualified personnel competent to complete the designated work. Contractors will provide training for their employees.

- First Aid/CPR, TDG, WHMIS, H_2S.

7. Personal Protective Equipment

All workers on Pieridae work sites must wear the following CSA approved standard personal protective equipment:

- Hard hat; safety glasses, safety-toed footwear; and fire retardant outer work wear/coveralls (clothing worn beneath fire retardant outerwear and against the skin should be made of flame resistant fabrics or natural fibres that will not melt when exposed to heat when working in hazardous areas).

Depending on the nature of the work and associated hazards, additional PPE may be required including:

- Hearing protection is required whenever noise levels above 85dBA exist.
- Fall protection systems are required where it is possible for a worker to fall a vertical distance greater than 3.0 metres (or where there is an unusual possibility of injury; or possibility of falling into or onto a hazard substance or object; or through an opening in a work surface).
- Respiratory protective equipment is required where there is exposure to airborne contaminants exceeding occupational exposure limits or oxygen deficiency.
- Personal monitors and/or gas meters are required where work involves exposure to an atmosphere that may contain a hazardous atmosphere (e.g. flammable, explosive, toxic gas or oxygen deficiency).

8. Incidents and Emergencies

In an emergency, workers must go to the muster or a safe area. Report emergencies to the Pieridae work site supervisor as soon as possible.

- The first person on the scene of an emergency must: protect themselves, assess the situation, notify the supervisor, evacuate the immediate work area, control the emergency until additional help arrives (depending on the situation) and record pertinent facts.
- All incidents must be reported to the Pieridae work site supervisor.
- All workers must be familiar with the location of fire extinguishers, eye wash stations, SDS sheets, the first aid station and any other emergency equipment on site.

9. Right/Obligation to Refuse

No worker shall carry out any work or operate any equipment, if on reasonable and probable grounds, it is the belief that it will cause to exist an imminent danger to the health and safety of that worker or another worker present at the work site. Any worker who refuses to carry out work must notify the Pieridae work site supervisor. The work site supervisor must investigate and take action to eliminate the danger.

10. Enforcement

Each contractor requires a WCB account in good standing, insurance in the amount of $2,000,000, and a safety program that satisfies applicable provincial legislation. When the Pieridae work site supervisor conducts an orientation, safety meeting or issues a permit, the contractor agrees to these rules. Pieridae will audit payables for compliance. Non-compliant contractors will be prohibited from working for Pieridae.

The contractor is responsible to ensure compliance with its own safety program, Pieridae's HSE procedures and any applicable legislation and regulations that apply to the work. Those individuals who do not fulfill their safety responsibilities will become accountable for any problems their negligence creates and may be liable under the law. Contractors are expected to have a process in place to deal with non-compliant employees and subcontractors. Pieridae reserves the right to terminate contracts and discharge contractors who knowingly violate safety rules or work procedures.

11. Safety Ombudsman

Safety concerns must be addressed. Harassment and violence will not be tolerated. If anyone on site is not satisfied with safety performance or has safety concerns that cannot be satisfactorily addressed, contact the Safety Ombudsman without fear of reprimand at 403-261-5900.

PIERIDAE ENERGY

Calgary Head office: 403-261-5900
24 hour emergency: 1-866-267-5298

ACKNOWLEDGEMENT
2019-2020

I have read and understand Pieridae's Contractor's HSE Orientation pamphlet and agree to comply with Pieridae's standard procedures and regulatory requirements. Each contractor requires a WCB account in good standing, insurance in the amount of $2,000,000, and a safety program that satisfies applicable provincial legislation.

_____
Contractor/Company

_____
Name

_____
Business Phone/Cell Phone

_____
Signature

_____
Date

- -

_____
Pieridae Project/LSD/Field

_____
Pieridae Work Site Supervisor

_____
Signature

Not in use.

PIERIDAE ENERGY

Form – 06

Employee Orientation Checklist

Name:		**Position:**	
Type:	☐ Employee ☐ Contract Operator ☐ Consultant (Work Site Supervisor)		
Start Date:		**Area:**	
Supervisor:		**Position:**	

Administrative
To be completed by hiring supervisor including: review resume; check references; discuss prior job history/competencies; current job description, organization chart, supervisor, etc.

Training/Certificates Refer to HSE Program Section 4.5 Required Training		Drilling & Completions Required Training Refer to HSE Program, 13.5.2 Drilling & Completion Training Requirements	
☐	H_2S	☐	SARA
☐	First Aid/CPR	☐	Second Line Supervisor's Well Control (Drilling)
☐	WHMIS	☐	Well Service Blowout Prevention (Completions/Workovers)
☐	TDG	☐	Detection and Control of Flammable Substances (Optional for Drilling, required for Completions)
☐	Ground Disturbance (job dependent)	☐	Insurance ($2MM CGL & Vehicle), and WCB
Note: Copies of tickets will be provided at time of hire.			

HSE			
☐	HSE Program (provide employee with copy and obtain signed acknowledgement form)	☐	Personal Protective Equipment (fire retardant clothing, hard hat, steel-toed boots & safety glasses)
☐	Permit Books, Forms, Emergency Phone List	☐	Safe Work Permitting Procedure
☐	HSE Policy	☐	Contractor Safety (orientation requirements)
☐	HSE Responsibilities	☐	Hazard, Near Miss & Incident Reporting
☐	Right and Obligation to Refuse Unsafe Work	☐	Corporate ERP (including responsibilities)
☐	Hazard Assessment & Control (hierarchy of controls)	☐	Communication: safety meetings, corporate HSEC, monthly HSE Report.
Date Completed:			

Other Management Systems			
☐	Pipeline Integrity Management	☐	APEGA Profession Practice Management Plan
☐	Quality Assurance (Pressure Equipment Integrity Management, Management of Change, Preventative Maintenance)	☐ ☐	Damage Prevention and Public Awareness Program Emergency Management Program (ERP) and Corporate Security Plan
Date Completed:		Completed by:	

Work Site Tour			
☐	Location of First Aid Equipment	☐	Location of Fire Extinguishers
☐	Alarms, Muster Point, Emergency Phone List	☐	Location of Eyewash and Shower Stations
☐	Location of ESD's	☐	Housekeeping Expectations
☐	Location of Fire/Gas Detection	☐	Location of Specific ERP (if applicable)
Date Completed:			

Site Specific Procedures (Work Site Supervisor should list all those that are discussed)			
☐	Working Alone	☐	SDS Access (WHMIS 2015)
☐	Audiometric Testing (noise exposed employees)	☐	Site Specific ERP
☐	CMDS (Production Operator Competency)		
Date Completed:			

On-the-Job Training	
☐	Field/Facility Orientation
Date Completed:	

Acknowledgement		
I have participated in the employee orientation. The orientation covered the topics checked above. I understand my responsibilities and I will ask questions if in doubt.		
Employee's Signature:		Date:
Supervisor's Signature:		Date:

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Form – 06

Employee Orientation Checklist

CC: Supervisor, Employee, HSE

PIERIDAE ENERGY

Form – 07

Fire and Explosion Prevention Plan

Location:	
Date:	**Prepared By:**

DESCRIBE WORK TO BE DONE:

FIRE AND EXPLOSION HAZARDS (Are there components for a fire or explosion?)

Fuel / Hydrocarbon Sources:

Gases	Liquids / Vapors	Chemicals & Lubricants	Solids
☐ Natural Gas	☐ Crude Oil / Condensate	☐ Solvents and cleaning agents	☐ Wax ☐ Lubricants
☐ Hydrogen Sulphide	☐ NGL liquids	☐ Hydraulic fluids & lubricants	☐ Sealants
☐ LPG Gases (Including propane and butane)	☐ Hydrocarbon based drilling or frac fluids	☐ Chemicals used for well servicing and stimulations	☐ Packings, "O' rings, diaphrams and valve seats
☐Other gases such as hydrogen or acetylene	☐Gasoline, Diesel & other fuels		☐ Paints and Coatings
	☐ Methanol		

Energy / Ignition Sources:

☐ Hot Work	☐ Vehicles (exhaust piping, diesel engines)	☐ Open Flames (i.e. flare stacks, burners, torches)	☐ Electric Arcs and Sparks (i.e. non explosion proof equipment)
☐ Static Electricity	☐ Hot Surfaces	☐ Friction and Mechanical Sparks	☐ Chemical Reactions and Sparks (i.e. fuel – oxidizer reactions)
☐ Spontaneous Combustion	☐ Sudden Decompression	☐ Pressure / Compression Ignition (Dieseling)	☐ Pyrophors (such as iron sulphide from corrosion)
☐ Smoking	☐ Cell phones, pagers, radios	☐ Hypergolic reactions (e.g. frac chemicals)	☐ Other:

Air / Oxygen Sources:

Planned Introduction of Air

☐ Air-based operations	☐ Air Purging

Unplanned Introduction of Air

☐ Underbalanced operations ☐ Overbalanced	☐ Swabbing & other operations that create a vacuum	☐ Pockets of air created during the installation and servicing of equipment	☐ Oxidized (Weathered) Hydrocarbons
☐ Oxidizers	☐ Chemical Reactions	☐ On-Site Generated Nitrogen	☐ Tank Drawdown

REQUIRED CONTROLS (What are you doing to prevent components from combining?)

EMERGENCY CONTROLS (How will you respond if the conditions change?)

WORKERS TRAINED AND INFORMED	Complete
Workers have been made aware of and can recognize potential fire and explosion hazards and controls related to the planned activities.	☐
Affected workers have been made aware of this fire and explosion prevention plan.	☐

Wellsite Supervisor	Signature

PIERIDAE ENERGY

Form – 08

Ground Disturbance Permit

Location:		**Date:**	
Project Activities:	☐ New Installation ☐ Tie-in/Re-entry ☐ Repairs ☐ Construction ☐ Reclamation ☐ Other		
Pieridae Representative:		**Cell:**	
Contractor Representative:		**Cell:**	

		YES	NO	N/A
RECORD CONFIRMATION				
1.	Is a copy of the survey drawing onsite?	☐	☐	☐
2.	Is a copy of the Surface Acquisition Report onsite (if applicable)?	☐	☐	☐
3.	Does the survey drawing match the Surface Acquisition Report table of crossings?	☐	☐	☐
4.	If questions 1-3 are not applicable, has the proposed area of the disturbance and buffer zone been electronically scanned?	☐	☐	☐
5.	Is a copy of the Land Title Certificate or a Public Land Standing Report onsite?	☐	☐	☐
6.	Is a copy of the most recent provincial or company pipeline baseline map onsite?	☐	☐	☐
7.	Has the landowner been notified as required?	☐	☐	☐
8.	Are copies of all Crossing Agreements onsite?	☐	☐	☐
9.	Have Crossing Agreement notifications been made?	☐	☐	☐
10	Have field operations personnel been notified to review scope of work and crossings?	☐	☐	☐
11.	Have all pipelines, power lines and utilities in the 30 meter search/controlled area been identified?	☐	☐	☐
12.	Has the provincial One-Call System been contacted?	☐	☐	☐
VISUAL INSPECTION				
1.	Are all buried pipelines, power lines, cables and utilities identified on above drawings staked on the ground in proposed area?	☐	☐	☐
2.	Are overhead power line caution signs in place if required?	☐	☐	☐
3.	Are all the locate stakes or marks referenced to fixed features?	☐	☐	☐
4.	Are all the lines within the 30m search/controlled zone identified on the ground?	☐	☐	☐
5.	Are there any signs of new ground disturbances within the proposed working area, including the search/controlled zone? This may include pipelines, power lines, gas co-ops, utility cables, new clearings, road construction, pipeline signs, settlement, vegetation color change or change of vegetation growth. If there is any visual sign of activity that is not reflected on the survey drawing then re-surveying should be considered.	☐	☐	☐
PRE-CONSTRUCTION				
1.	Is the proposed ground disturbance expected to be less than 30cm deep? (Caution: Ground disturbances less than 30cm may encounter lines improperly installed or changed due to shifting ground conditions.)	☐	☐	☐
2.	Are there any pipelines, power lines, cables or utility cables being crossed within the distance outlined in the crossing agreements or within 5m where there is no right of way?	☐	☐	☐
3.	Are all the conditions of the crossing agreements being met?	☐	☐	☐
4.	Have all underground facilities been hand-exposed or hydrovaced as per the company requirements, crossing agreements and regulations?	☐	☐	☐
5.	No mechanical excavation is permitted within one metre of exposed pipelines (or as specified in crossing agreements and regulations). If less than one meter, specify:			
6.	Has a pre-job safety meeting been conducted?	☐	☐	☐
	If any item of the above items are marked "no", approval is required from the supervisor and should be documented here.			
OTHER CONSIDERATIONS				
1.	If deemed appropriate by the work site supervisor, a safe work permit should also be completed.			
2.	Pieridae requires that a representative be onsite when its own pipelines are being crossed.			
3.	Is any other owner of underground facilities required to be present when excavating or exposing its lines?	☐	☐	☐
4.	Have owners been given 24 hours prior to backfill? A Backfill Inspection Report is required.	☐	☐	☐
5.	Has a designated smoking area been identified?	☐	☐	☐

Signatures: Work Site Supervisor: Contractor:

Original – Project File (Retain a minimum of two years.) Copy - Contractor

PIERIDAE ENERGY	Form 09 Hazard Alert/ Near Miss Report

Area:	**Location/LSD:**
Description of hazard or near miss:	
Risk Assessment: ☐ **High** – Probable/Imminent Danger ☐ **Medium** – Likely/Serious Danger ☐ **Low** – Unlikely/Minor Danger	
Cause:	
Corrective actions taken:	
Name:	**Date:**

PIERIDAE ENERGY

Form – 10

HSE Assessment

Facility Name:		**Location:**		**Date:**	
Assessor 1:		**Assessor 2:**		**Operator:**	
Date of previous HSE Assessment:			**Is there a copy of previous HSE Assessment for review:**		
Were any deficiencies noted during the previous HSE Assessment? (If so describe or attach previous action plan.)					
Are there any outstanding follow-up actions?					

	Documentation	**Yes**	**No**	**N/A**	**Comments**
1	Do all full-time operations staff and contract operators have a HSE Program? • Are acknowledgement forms signed and on file?	☐ ☐	☐ ☐	☐	
2	Are HSE Program forms available and being used as required (Safe Work Permits, Ground Disturbance Permits, Incident Reports, etc.)?	☐	☐	☐	
3	Are Contractor's HSE Orientation pamphlets available and being used as required?	☐	☐	☐	
4	If required, is a specific ERP on site?	☐	☐	☐	
5	Are site specific procedures and equipment maintenance and operating manuals on site?	☐	☐	☐	
6	Are safety meetings held regularly? • Scheduled safety meetings? Are minutes documented, distributed and available for review? • Pre-job safety meetings?	☐ ☐ ☐	☐ ☐ ☐	☐	
7	Are ABSA Certificate of Inspection permits available on site and/or electronically available?	☐	☐	☐	
8	Are ABSA regulated pressure equipment inspection records and PSV servicing records available on site?	☐	☐	☐	
9	Are copies of monthly HSE Reports available?	☐	☐	☐	
10	Is a copy of the local Oil Spill Cooperative binder available?	☐	☐	☐	
11	Are current (M)SDS sheets available?	☐	☐	☐	
12	Is there a wildfire protection plan? Is the facility in compliance with the plan?	☐ ☐	☐ ☐	☐	
13	Are standard references available on site and/or via the internet? • OH&S Statutes and Regulations • Specific Oil and Gas legislation	☐	☐	☐	

Documentation		Yes	No	N/A	Comments
14	Have any external regulatory inspections been completed on the site recently? Are records available for review?	☐	☐	☐	

Safety		Yes	No	N/A	Comments
15	Do all workers have current required training? • WHMIS, TDG, First Aid/CPR, H_2S?	☐	☐	☐	
16	Do all workers have appropriate personal protective equipment? • Hard hat, steel toed boots, fire resistant coveralls, and safety glasses? • Is other PPE available as required/posted (e.g. personal monitors, hearing protection, proper chemical handling clothing etc.)?	☐ ☐ ☐	☐ ☐ ☐	☐	
17	Is a communication plan/system available for employees required to work alone? • Is a site specific procedure available? • Is it being followed?	☐	☐	☐	
18.1	Is proper facility signage in place? Do signs contain: • Name and telephone number; • Legal description of location; and • Appropriate warning symbols.	☐	☐	☐	
18.2	Do controlled products have WHMIS labels?	☐	☐	☐	
18.3	Is noise exposure signage posted? • Noise levels above 85dBA must be posted.	☐	☐	☐	
19	Is the facility equipped with appropriate eyewash stations? • Unobstructed? • Situated for quick access? • Marked with clear signage?	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐	
20	Is there appropriate first aid equipment on site?	☐	☐	☐	
21.1	Are stairways equipped with handrails?	☐	☐	☐	
21.2	Does facility have appropriate fall protection equipment?	☐	☐	☐	
21.3	Are combustible gas meters available at the facility?	☐	☐	☐	
21.4	Is appropriate respiratory equipment available at the facility? • Are workers trained to use the respiratory equipment? • Have fit tests been conducted and documented?	☐ ☐ ☐	☐ ☐ ☐	☐	
21.5	Is isolation equipment (i.e. lock out/tag out) available at the facility?	☐	☐	☐	
21.6	Is the facility equipped with appropriate fire fighting equipment? • Is fire equipment inspected and properly maintained?	☐ ☐	☐ ☐	☐	
21.7	Is facility equipment and piping properly isolated? • Blinds/blanks, blind flanges, double block and bleed.	☐	☐	☐	
22	Is the perimeter of the facility fenced and locked?	☐	☐	☐	
23	Is the facility equipped with fire and gas detection?	☐	☐	☐	

24	Does the facility have an H_2S monitoring system?	☐	☐	☐	
25	Is the facility equipped with a sufficient ESD system?	☐	☐	☐	
26	Is there safe access and egress to and from the site and buildings? Are building exits clearly marked and free of obstructions? Are building doors equipped with panic hardware?	☐ ☐ ☐	☐ ☐ ☐	☐	
27	Are buildings properly vented?	☐	☐	☐	
28	Are buildings properly illuminated?	☐	☐	☐	
29	Is there proper spacing between equipment?	☐	☐	☐	
30	Is all moving equipment guarded?	☐	☐	☐	
31.1	Do truck loading/unloading areas have procedural signs in place?	☐	☐	☐	
31.2	Do truck loading/unloading areas have adequate fire fighting equipment available?	☐	☐	☐	
31.3	Are truck loading/unloading areas properly grounded?	☐	☐	☐	
31.4	Do truck loading/unloading areas have enviro-boxes or drip pans in place?	☐	☐	☐	
32	Is equipment properly guarded from vehicle traffic?	☐	☐	☐	
33	Are good housekeeping practices followed?	☐	☐	☐	

Environment		**Yes**	**No**	**N/A**	**Comments**
34	Are necessary regulatory approvals in place at the facility? • Is the facility in compliance with the conditions of the approvals?	☐	☐	☐	
35	Are drains tied into suitable tankage?	☐	☐	☐	
36	Is surface runoff handled properly? • A lease dike or other containment system is required for any well or battery within 100m of a body of water or permanent stream. • Does disposal meet requirements regulatory approvals, if applicable? • Are proper discharge procedures followed?	☐	☐	☐	
37.1	Is a flare system in place where required? • Are proper flare ignition devices in place? • Does flare stack location comply with spacing requirements? • Does flare stack height appear comply with regulations? • Are flare stacks equipped with wind guards? • Is there a flare separator/knockout drum? • Is it equipped with a high-level alarm? • Is the area around the base of the flare stack blackened to prevent fires? • Is a flare form and procedure in place and a decision tree posted and available?	☐	☐	☐	

Environment		Yes	No	N/A	Comments
37.2	Are there any flare pits on site?	☐	☐	☐	
37.3	Are venting practices conducted in accordance with Directive 60? • Are all sour tank vapours conserved or gathered and burned? • Do all sour pressure relief valves tie into a flare stack? • Are vent lines from storage tanks to flare stacks equipped with flame arresters?	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	
37.4	Are procedures and/or automatic shutdowns in place to control major sour/acid gas flaring events?	☐	☐	☐	
38	Do compressors larger than 600 kW utilize low NOx technology? Is compressor exhaust stack height appropriate?	☐ ☐	☐ ☐	☐ ☐	
39.1	Do storage area locations meet requirements?	☐	☐	☐	
39.2	Do storage areas contain signs that indicate type of materials being stored, warnings and general housekeeping procedures?	☐	☐	☐	
39.3	Are storage tanks designed in accordance with Directive 55? • Double walled storage tanks >5m^3 require overfill protection and vehicle traffic protection.	☐	☐	☐	

39.4	Do storage areas have appropriate secondary containment?
	• Storage tanks >5m^3 require secondary containment in the form of:
	  • A lined dike that can contain 110% of the capacity of the tank for one tank or 100% of the capacity of the largest tank plus 10% of the aggregate volume of the remainder of the tanks for more than one tank.
	  • Double walled tank (additional design and monitoring requirements involved).
		☐	☐	☐	

39.5	Are storage tanks inspected monthly and are records available? • Double walled storage tanks >5m^3 require monthly interstitial space monitoring.	☐	☐	☐	
39.6	Are stored materials consumed within two years? • Are oilfield wastes stored for more than one year? • Does temporary storage of materials exceed three months?	☐ ☐ ☐	☐	☐	
40	Are waste management areas adequately fenced? Are proper waste management techniques being followed? • Proper disposal (DOW & NDOW)? • Proper documentation (i.e. waste manifests)?	☐ ☐ ☐	☐ ☐ ☐	☐	
41	Have there been oil/saltwater or other spills and are they handled correctly? • Are off lease spills or spills >2m^3 reported to the regulator? • Are spills of refined products reported to the regulator?	☐ ☐ ☐	☐ ☐ ☐	☐	
42	Are permissible sound levels met?	☐	☐	☐	
43	Have there been any landowner complaints? • Noise, vegetation, odours?	☐	☐	☐	
44	Is there an effective vegetation management strategy on site?	☐	☐	☐	

Environment		Yes	No	N/A	Comments
45	Are DEOS posted at glycol dehydrators? Is the site in compliance with D039 requirements?	☐ ☐	☐ ☐	☐ ☐	
46	Is a site specific fugitive emissions procedure in place and followed?	☐	☐	☐	
47	Are there any active remediation projects being conducted onsite?	☐	☐	☐	

Vehicle Safety		Yes	No	N/A	Comments
47	Do vehicles have adequate communication systems? • Are they equipped with two-way radios, cell phones?	☐ ☐	☐ ☐	☐	
48	Are all permanent full-time employees & contractor vehicles equipped with proper safety equipment? • Do vehicles have fire extinguishers, first aid kits, flares, etc.?	☐ ☐	☐ ☐	☐	
49	Are company vehicles in good repair? • Are they regularly maintained, clean, equipped with spare tire? • Is a vehicle inspection checklists completed?	☐ ☐ ☐	☐ ☐ ☐	☐	

Comments/Sketch

Action Plan

Describe action items required to correct any deficiencies. Include person responsible for action and anticipated completion date. Please correlate comments to the numbers indicated on the HSE Assessment Form.

Facility Name: _____ Assessor 1: _____

Location (LSD): _____ Assessor 2: _____

Type of Facility: _____ Operator: _____

Inspection Date: _____

#	Action Item	Person Responsible	Date to be Completed

Action Items Completed:

Date: _____ _____ _____

Operator Signature Supervisor Signature

PIERIDAE ENERGY

Form – 11a

Incident Report

Date of Report:			
Date Incident Occurred:		**Time:**	
Location of Incident (LSD):		**Area/Field:**	
Pieridae Supervisor:		**Reported By:**	
Title/Job Position:		**Title/Job Position:**	

Incident Summary (brief description of what happened):

Incident Description

☐ Employee ☐ Contractor	☐ First Aid Only Injury ☐ Medical Aid Injury ☐ Worker Admitted to Hospital *(Employer WCB forms may be required)*	☐ Spill/Release *(Form 11d - Spill/Release Report required)* ☐ Vehicle Incident *(Form 11c - Vehicle Accident Report required)* ☐ Other (please describe):

Sequence of Events

*Relevant events in chronological order that happened: activity/work prior to the incident, contact point/reason for incident, and immediate actions following the incident. Identify who (function/position, **not** name), what, where, when, why. Facts only. Avoid acronyms, jargon. Attach/include: diagrams, photos, copies of relevant correspondence, and contractor incident and investigation reports (if applicable).*

Date	Time	Events

Immediate Corrective Actions Taken:

Further Investigation Report Required? ☐No ☐Yes *(If yes: Form 11b – Investigation Report required)*

Supervisor:	Name	Title	Date Reviewed

PIERIDAE ENERGY

Form – 11b

Investigation Report

Location of Incident:		Date Incident Occurred:	
Site Inspection:	☐ No ☐ Yes, by whom:	Inspection Date:	

Background to the Incident	**Summary and assessment of conditions and events immediately preceding the incident:**

Description of the Incident	**Summary of the event (time occurred, description of circumstances, actions taken in response):**

Cause	**Actual or suspected cause and the rationale used to determine the cause:**

Notifications		**Name**	**Phone**	**Date/Time**
	Supervisor			
	Management			
	Regulator			
	RCMP/Fire Department etc.			
	Occupational Health and Safety			
	Environmental Regulator			
	Landowner			

Recommendations	**Corrective actions to improve existing operations:**	**Person Responsible**	**Target Date**

Recommendations	**Corrective actions to prevent future occurrences:**	**Person Responsible**	**Target Date**

Cost Estimate			
	Equipment damage and repair. Describe:		
	Clean up and remediation. Describe:		
	Is an AFE required? ☐No ☐Yes AFE #	**Total $**	

ERP Evaluation	AER Emergency Level: ☐Alert, ☐Level 1, ☐Level 2 or ☐Level 3 or ☐N/A
	ERP implementation evaluation and comments:

Reviewers	**Reviewer**	**Title**	**Name**	**Date**
	Field Personnel			
	Supervisor			
	Management			

Original – Fax/submit to supervisor within 72 hours of the incident.

PIERIDAE ENERGY

Form – 11c

Vehicle Accident Report

Date		Time	
Area		Field	
Location	*(LSD, Street, Highway, City, Province etc.)* Private Road (e.g. logging road) ☐ Yes ☐ No		
Drivers Name		Passengers ☐ No:☐ Yes If yes, how many passengers:	
License Plate		Vehicle Description:	
What purpose was vehicle being used at time of accident?			

Driver Authorized?	Drivers License #:	Posted Speed Limit:	Speed Before Incident:
☐ Yes ☐ No		km	km

Other Drivers Name		Drivers License #	
Other Drivers Address & Phone Number			
Other Vehicle Owners Name		Insurance Company and Policy#	
Owners Address			
Other Vehicle Description		License Plate #	
Description & Location of Damage to Other Vehicle			

Witnesses Name(s), Address(es) and Phone Number(s) & In Which Car

			☐ Your car ☐ Other car ☐ Other
			☐ Your car ☐ Other car ☐ Other

RCMP Collision Report Completed? ☐ Yes ☐ No By:

Did police make a report? Charges Laid? ☐ No ☐ Yes - If yes, against whom:

Road Data

Location of Accident
☐ Intersection ☐ Wellsite
☐ Curve ☐ Access Rd
☐ Straightaway ☐ Public Rd
☐ Bridge

Road Effects
☐ Under Repair ☐ Obstruction
☐ Defective Shoulders ☐ Other
☐ Holes, Ruts, Bumps

Traffic Controls
☐ Stop Sign
☐ Stop Light
☐ Officer/Flagman

Condition
☐ Dry
☐ Wet
☐ Mud
☐ Snow
☐ Ice

Surface
☐ Dry
☐ Gravel
☐ Packed
☐ Loose
☐ Pavement

Grade
☐ Uphill
☐ Downhill
☐ Level

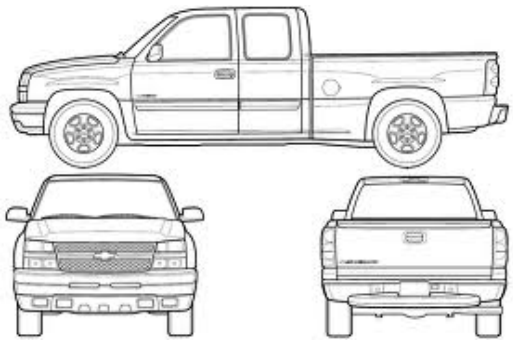
Weather
☐ Clear
☐ Cloudy
☐ Fog
☐ Rain
☐ Snow

Light
☐ Daylight
☐ Dusk
☐ Dawn
☐ Streetlights
☐ Dark

Vehicle Accident Report

Describe what happened and give exact location of accident.

Sketch what happened. *(Include: north, highways/roads, path before accident, collision point etc.)*



Indicate Damage on Vehicle *(Mark with X)*

Vehicle Repairs: $	Estimated By:
Other Vehicle/Property Repairs: $	Estimated By:

Cause of Accident *(Please mark with an X those that apply)*

- ☐ Roadway
- ☐ Mechanical
- ☐ Environmental
- ☐ Driver/distraction
- ☐ Other *(specify)*:

Driver:	**Date:**	Is a WCB Automobile Accident Report form required and attached? ☐ Yes ☐ No
Supervisor:	**Date:**	Is an RCMP collision report required and attached? ☐ Yes ☐ No

Original – Fax/submit to supervisor within 24 hours.

PIERIDAE ENERGY

Form – 11d

Spill/Release Report

Date:	**Time:**
Reported by:	**Phone:**
Location (LSD):	**WCSS Area/Manual:**

Location of release: *(e.g. pipeline, wellsite and tank, wellhead, flare etc.)*

General description of surrounding area/land use: *(e.g. cultivated land, pasture, forested crown land etc.)*

What are the ground conditions: ☐ Wet ☐ Dry ☐ Frozen ☐ Muskeg ☐ Standing Water ☐ Flowing Water

If spill is in water → what is the name of the lake, river or stream?

What are the weather conditions? *(e.g. temperature, precipitation, snow, etc.)*

Approximate volume of product spilled: **m^3** Is there H_2S? ☐ No ☐ Yes ppm

Type of product *(e.g. oil, produced water, condensate):* Is an (M)SDS available? ☐ No ☐ Yes

If spill volume exceeds 2.0m^3 or is offsite, the spill must be reported to the regulator. Additional forms may be required.

Is spill ongoing?	**Is spill contained?**	**Is the spill:** ☐ Onsite ☐ Offsite
☐ No ☐ Yes	☐ No ☐ Yes	**Is the release a flare event?** ☐ No ☐ Yes
If Yes → Explain:	Explain:	**Is the spill a trucking incident?** ☐ No ☐ Yes

Is the health or safety of any individual (residents, communities, etc.) being compromised?

☐ No ☐ Yes

If Yes → Explain:

AER Emergency Level: ☐ Alert ☐ Level 1 ☐ Level 2 ☐ Level 3 or ☐ N/A

If pipeline → then answer: Licence #: Line #: Pipe size: MOP:

Response Details

Corrective Action Taken:

Landowner Contacted: *(As required)*	Name:	Callback Number:	Date/time:	Requests:
Regulator Contacted: *AER 1-800-222-6514*	Name:	Callback Number:	Date/time:	Agency requests:

Regulatory Follow Up Required? Date:

AER 7-day letter required? ☐ Yes ☐ No Reclamation report required? ☐ Yes ☐ No

Investigation

Cause of spill: *If required, complete Form 11b – Investigation Report.*

Nature and extent of damage? *What are the obvious impacts to the environment (e.g. wildfire, water pollution, wildlife, air quality, vegetation damage, surface disturbance, other, etc.)*

Follow up required?

Cost estimate?

Original – fax/submit to supervisor within 24 hours.
Note: Records of pipeline leaks, breaks or contact damage must be retained for the life of the pipeline system.

Sketch - *Indicate: location in relation to known features (wellhead, perimeter fence etc.), north/directions, waterbodies, access roads, right-of-way, fences, and residences. If a complex response include: containment and recovery efforts (e.g. spill recovery site equipment layout including dikes, straw booms, bellholes, wind direction, muster point, staging area etc.)*

PIERIDAE ENERGY

Form – 11e

Witness Statement

Date:	
Witness Name:	
Incident:	
Incident Location:	

Description

Date Witness Statement Provided:	
Witness Signature:	

PIERIDAE ENERGY

Form – 12

Job Hazard Analysis

Task	Who does it?	What are the hazards?	**Risk** low, medium, high	**How to prevent incident?** (i.e. Elimination, substitution, engineering controls, administrative controls, PPE)

Comments:

1. **JHA completed by (list names):**
2. **Date Completed:**
3. **JHA reviewed by:**
4. **Engineering input required? ☐ Yes or ☐ No**
5. **Site specific procedure required? ☐ Yes or ☐ No**

NOTE: Site specific procedures should be developed for certain critical tasks where a standard operating procedure does not exist or where more specific instruction is required. The HSE Program, Section 9.0 Standard Operating Procedures can be used as a guideline when developing site specific procedures. Additionally, regulations and manufacturer's specifications and instructions can be used.

PIERIDAE ENERGY

Form – 13

Lock Out

Work to Be Done:	

#	Size	Isolation Description	Isolated Position: Open/Closed	Lock	Tag

Isolated By (Operations):		
Name	Signature	Date

Isolated By (Contractor/Craftsman):		
Name	Signature	Date

Returned to Service By (Operations):		
Name	Signature	Date

PIERIDAE ENERGY

Form – 14

Management of Change Authorization

Refer to Quality Assurance Manual.

PIERIDAE ENERGY

Form – 15

Monthly HSE Inspection Checklist

Facility/ Field	
LSD:	
Date:	
Name:	

Yes	No	
☐	☐	Wellsite identifier and associated pipeline signs in place and current
☐	☐	Housekeeping good
☐	☐	Warning signs in place
☐	☐	Gates/fences in acceptable condition
☐	☐	Vegetation controlled
☐	☐	Surface runoff water controlled and released as per procedures
☐	☐	Fire extinguishers where required
☐	☐	First aid kit where required
☐	☐	Fire blanket where required
☐	☐	Hearing protection available where required
☐	☐	No visible signs of leaks, drips or spills around production tanks or at load outs
☐	☐	Instructions and grounding/bonding appropriate at load outs
☐	☐	Equipment guards in place where required
☐	☐	Noise levels acceptable
☐	☐	No known landowner complaints or concerns
☐	☐	No spills or leaks on the site
Regarding above ground and below ground tanks and containment, complete below or refer to more detailed D055 checklist as may be contained in a site specific procedure.		
☐	☐	Secondary containment as per regulations
☐	☐	UST's onsite and tested as per regulations
☐	☐	AST's onsite and tested as per regulations

Comments **(for any box checked "no" please include comments regarding required work and/or actions).**

PIERIDAE ENERGY

Form – 16

Pre-Job Safety Meeting Report

Date:	
Location:	
Job:	
Supervisor Name:	

ATTENDANCE

Name	Company		Name	Company

Job Description:

Site Specific Hazards:

Safety Precautions / Hazard Controls (e.g. signs, barricades, isolation, etc.):

Site Specific Procedures (e.g. confined space entry):

Personal Protective Equipment:

Emergency Procedures (e.g. muster location, emergency phone list location, alarms etc.):

1. **Is a safe work permit required?**
2. **Are any other permits required (e.g. ground disturbance, confined space)?**
3. **Have contractors received an orientation (i.e. copy of the Contractor's HSE Orientation pamphlet)?**

Work Site Supervisor (signature) _____

PIERIDAE ENERGY

Form – 17

Resident Flaring, Venting, Incineration Notification Form

Pieridae Energy will be flaring/incinerating/venting a (___ % H_2S) well in accordance with regulatory requirements at the location stated below.

Flaring/Incinerating/ Venting Category (check those that apply)

☐ Well test flaring
☐ Well test venting
☐ Well test incinerating

Check One:

☐ Oil well
☐ Gas well

AER Energy and Environmental Emergency 24-Hour Response Line 1-800-222-6514

AER Office (check one)

☐ Bonnyville (780-826-5352)
☐ Drayton Valley (780-542-5182)
☐ Grande Prairie (780-538-5138)
☐ Fort McMurray (780-743-7141)
☐ High Level (780-926-5399)
☐ Medicine Hat (403-527-3385)
☐ Midnapore (403-297-8303)
☐ Red Deer (403-340-5454)
☐ St. Albert (780-460-3800)
☐ Wainwright (780-842-7570)

Flaring/Venting/Incinerating Comments

Well Licence No.	
Well Name	
Location of Well (LSD)	
Estimated Flare/Incinerate/Vent Timing (30-day window)*	
Estimated Start Date	
Estimated End Date	
Flaring/Incinerating/Venting Duration	
Estimated Volume (10^3 m^3/day)	
Operator Name	
Operator Contact Name	
Contact Phone Number	
Testing Contractor	
Testing Representatives on Site	Daytime Number Nighttime Number
Emergency Phone Number	1 -866-267-5298

*30-day window is to accommodate for weather and operational delays.
Renotification is mandatory after 90 days.

If you would like notification 24 or 48 hours in advance of flaring/ incinerating/venting operations or if you have any questions or concerns please contact: _____

Notes:_____
_____
_____

PIERIDAE ENERGY

Form – 18

Safe Work Permit

Date:	Valid From:	Valid To:	Blanket permit? ☐

1. Contractor(s)			Orientation Completed?
Company Name:		# of Workers:	☐
Contact Name:		Phone #:	

2. Job	
Applicable LSD(s):	
Type of Permit: ☐ Hot Work ☐ Cold Work	Description of the work to be completed:

3. Special Instructions

☐ A pre-job safety meeting is required. Contractor representatives must attend or the permit receiver(s) must relay information.
☐ Ground disturbance requires completion of a ground disturbance permit and, if crossing another facility, a backfill inspection report.
☐ Confined space entry requires completion of a confined space entry permit and/or an equivalent form and watchman's log.
☐ Isolation (lock out tag out) may require completion of a lock out and/or blind list form.
☐ Cellular phones and relay-activated horn alerts must be turned off in hazardous areas.

4. Work Site Inspection *Contractor should also complete a field level hazard assessment (FLHA)*

Has the work site been inspected? ☐ Yes ☐ No – If no, explain why:

5. Hazard Identification

☐ Toxic atmospheres (e.g. H_2S)	☐ Limited access / egress	☐ Excavation / trenching	☐ Working alone
☐ Oxygen deficiency	☐ Working at heights / falling	☐ Underground equipment / lines	☐ Weather / road / lease conditions
☐ Flammable gases / liquids	☐ Rotating equipment	☐ Overhead electrical lines	☐ Housekeeping / lighting
☐ Energy / ignition source	☐ Pressurized equipment	☐ Moving vehicles / equipment	☐ Extreme temperatures
☐ Oxygen / air	☐ Excessive noise (greater than 85dB)	☐ Fatigue	☐ Exposure to hazardous materials
☐ Fire & Explosion Hazard	☐ Electrical hazards	☐ Other (see below)	☐ Radioactive / NORM

6. Hazard Controls

PPE

☐ Standard
(hard hat, fire retardant coveralls, steel toed boots/shoes & safety glasses)
☐ Hearing protection
☐ Safety harness
☐ Life line
☐ Fall protection
☐ Personal monitor
☐ Respiratory equipment
☐ SCBA / SABA equipment

Safety Data Sheet (SDS): _____

Safety Equipment

☐ Barricades
☐ Warning signs
☐ Additional fire equipment
☐ WHMIS / TDG compliance
☐ Waste streams managed
☐ Watch person required
☐ Other _____

Ventilation

☐ Air
☐ Steam
☐ Inert gas purge
☐ Water flood
☐ Other _____

Isolation

☐ Electrical ☐ Mechanical
☐ Locked and tagged
☐ Blinded or blanked
☐ Cathodic protection off
☐ Disconnected
☐ Depressured
☐ Drained *(lines open)*
☐ Vented *(lines open)*
☐ Drains / sumps (*covered)*
☐ Equipment grounded
☐ Emergency systems bypassed

Atmospheric Testing

Testing completed? ☐ Yes ☐ No
By: _____
Initial readings:
O_2 _____ (19.5-23% is acceptable)
LEL% _____ (Must not exceed 20% of LEL)
H_2S ppm _____ (Must not exceed 10ppm)

Continuous monitoring and/or testing required?
☐ Yes ☐ No

Environmental conditions:
☐ Wind? ☐ Yes Direction: _____
☐ Calm
☐ Low Humidity (Static Electricity)

Other hazards and controls:

7. Emergency Procedures and Incident Reporting ☐ Muster area?

☐ Emergency procedures reviewed? ☐ Incident reporting reviewed? ☐ Cellular communication possible? ☐ Yes ☐ No

8. Agreement (Please read/review and understand hazards and controls prior to signing). Post or make readily available.

This agreement is valid only so long as work conditions existing at the same time of its issuance continue and expires upon occurrence of any hazard such as gas leak, liquid spill, drastic operating change or environmental conditions. Any worker will have the right to stop the job if there are reasonable grounds to believe that the job is, or likely to become, unsafe. If a worker refuses work, work shall not resume until the permit is renewed and a hazard is addressed. The contractor agrees to abide by all provincial, federal and local laws and regulations governing the work contemplated by this agreement and warrants that its employees and subcontractors are competent to undertake the specified work and will comply with applicable legislation.

Issuer: *(Pieridae Rep)*		Phone:		Signature:

Receiver(s):

Name:	Signature:	Name:	Signature:

9. Permit Renewal (all conditions of permit must be reviewed and followed):

Conditions that would void this agreement and require revalidation include any emergency, time expired and crew/shift change.

☐ Revalidation Date: Time: Issuer Initials: Receiver Initials: (If multiple, indicate above.)

☐ Permit close out/work complete. Date Issuer Initials:

PIERIDAE ENERGY

Form – 18a

SIMOPS Form (Simultaneous Operations)

Area:	Well Name/Location:	Surface Location:	Date:

Job Description	Name:	Phone:	Signature:
Operations Supervisor			
Facilities/Pipeline Supervisor			
Drilling Supervisor			
Completions Supervisor			
Construction Supervisor			

Each supervisor is responsible communicate the SIMOPS before work proceeds (e.g. as part of the daily safety meeting and/or kick off meeting with their crews).

Below are the responsibilities that can be delegated amongst the supervisory team. Identify who is responsible.	
• Update the SIMOPS work form and hazard board in the operations trailer as needed.	☐ Operations ☐ Facilities/Pipeline ☐ Drilling ☐ Completions ☐ Construction
• Ensure the supervisors, crews and hazard board all have an updated copy of the SIMOPS work form.	☐ Operations ☐ Facilities/Pipeline ☐ Drilling ☐ Completions ☐ Construction
• Implement required SIMOPS controls based on the task-specific SIMOPS activity.	☐ Operations ☐ Facilities/Pipeline ☐ Drilling ☐ Completions ☐ Construction
• Verify safe work areas have been established prior to commencing SIMOPS.	☐ Operations ☐ Facilities/Pipeline ☐ Drilling ☐ Completions ☐ Construction
• Ensure site access control.	☐ Operations ☐ Facilities/Pipeline ☐ Drilling ☐ Completions ☐ Construction
• Ensure personnel receive site-specific safety orientation.	☐ Operations ☐ Facilities/Pipeline ☐ Drilling ☐ Completions ☐ Construction

This section is to be filled out if any supervisor (Single Point of Accountability or SPA) leaves their position at any time. The SPA's delegate must be identified along with the intended duration of the delegation. All supervisors must be informed of the change and the hazard board updated in the operations trailer.

Job Description	SPA Delegate	Time	to	Time
Operations Supervisor				
Facilities/Pipeline Supervisor				
Drilling Supervisor				
Completions Supervisor				
Construction Supervisor				

If deemed appropriate, necessary, or relevant by the onsite team is there one person/supervisor who has been designated as the overall site supervisor to which all other supervisors must report? ☐ *No* ☐ *Yes If yes-whom:*

SIMOPS Form (Simultaneous Operations)

Operations – applicable ☐ Yes ☐ No	
Planned activity summary:	
Identify SIMOPS Risks: ☐ Movement of equipment outside of safe work area ☐ Pressure testing ☐ Potential gas release ☐ Hot work ☐ Other	Additiohnal SIMOPS Risks/Comments:
SIMOPS Mitigation Controls ☐ Safe work area established and marked (e.g. with cones or fencing) ☐ Safe work are identified on hazard board ☐ Gas detection ☐ Other	Additional SIMOPS Controls:
Facilities/Pipeline Construction – applicable ☐ Yes ☐ No	
Planned activity summary:	
Identify SIMOPS Risks: ☐ Movement of equipment outside of safe work area ☐ Pressure testing ☐ Potential gas release ☐ Hot work ☐ Other	Additiohnal SIMOPS Risks/Comments:
SIMOPS Mitigation Controls ☐ Safe work area established and marked (e.g. with cones or fencing) ☐ Safe work are identified on hazard board ☐ Gas detection ☐ Other	Additional SIMOPS Controls:
Drilling – applicable ☐ Yes ☐ No	
Planned activity summary:	
Identify SIMOPS Risks: ☐ Movement of equipment outside of safe work area ☐ Pressure testing ☐ Potential gas release ☐ Hot work ☐ Other	Additiohnal SIMOPS Risks/Comments:
SIMOPS Mitigation Controls ☐ Safe work area established and marked (e.g. with cones or fencing) ☐ Safe work are identified on hazard board ☐ Gas detection ☐ Other	Additional SIMOPS Controls:

SIMOPS Form (Simultaneous Operations)

Completions – applicable ☐ Yes ☐ No	
Planned activity summary:	
Identify SIMOPS Risks: ☐ Movement of equipment outside of safe work area ☐ Pressure testing ☐ Potential gas release ☐ Hot work ☐ Other	Additiohnal SIMOPS Risks/Comments:
SIMOPS Mitigation Controls ☐ Safe work area established and marked (e.g. with cones or fencing) ☐ Safe work are identified on hazard board ☐ Gas detection ☐ Other	Additional SIMOPS Controls:
Construction – applicable ☐ Yes ☐ No	
Planned activity summary:	
Identify SIMOPS Risks: ☐ Movement of equipment outside of safe work area ☐ Pressure testing ☐ Potential gas release ☐ Hot work ☐ Other	Additiohnal SIMOPS Risks/Comments:
SIMOPS Mitigation Controls ☐ Safe work area established and marked (e.g. with cones or fencing) ☐ Safe work are identified on hazard board ☐ Gas detection ☐ Other	Additional SIMOPS Controls:

Additional SIMOPS Risks/Controls/Comments identified at the SIMOPS daily meeting?

PIERIDAE ENERGY

Form – 18b

Handover Form

Area:	Well Name/Location:	Surface Location:	Date:

Handover from:

Job Description/Title	Name	Phone	Date/Time:

Handover to:

Job Description/Title	Name	Phone	Date/Time:

Please check all appropriate issues that were addressed:

- ☐ Well Status
- ☐ Maintenance Program
- ☐ AER D055 Forms
- ☐ Corrosion Program
- ☐ Metering/Calibration Program
- ☐ Lease Clean & Tidy
- ☐ Ongoing Issues

Description of handover:

Actions:

Signatures:

Handover from:

Handover to:

PIERIDAE ENERGY

Form – 19

Safety Meeting Minutes

Date:		**Field:**	
Location:		**Chairman:**	

Attendees:

Name	Company	Signature

Old Business:

Issue	Action Taken	Completed Date

PIERIDAE ENERGY

Form – 19

Safety Meeting Minutes

New Business:

Discussion Topic:			
Issue	Action Required	Responsibility	Target Date

Next Meeting Date:		**Start time:**		**Location:**	
Chairman:					
Note-taker:					

Retain on file at field office.

PIERIDAE ENERGY

Form – 20

Site Specific Procedure

OPERATING AREA:

APPLICABLE FACILITIES:

PROCEDURE:

PURPOSE:

HSE CONSIDERATIONS:

PROCEDURE:

REFERENCES:

PIERIDAE ENERGY

Form – 21

Surface Water Runoff Release

Facility/ Field	
LSD:	
Name:	
Date:	

Volume of water released: _____ m^3

Landowner/occupant consent obtained: ☐ Yes ☐ No ☐ N/A

Onsite Testing

Parameter	Test Method	Regulatory Limit	Results
pH	Test strip or pH meter	6.0-9.0	
Oil & Grease	Visual	No visible sheen	
Chlorides	Test strip	<500mg/L	

Notifications

Name	Date/Time Notified	Follow-up required?
Supervisor		
Landowner:		
Other:		

Laboratory Analysis

Contaminated water must not be released into the environment. If chemical contamination is suspected (i.e. spill/release has occurred, site exhibits poor housekeeping, etc.) contact an approved laboratory and/or environmental consultant to determine what additional sampling and analysis should be conducted.

Comments

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Form – 22

Watchman's Log

Date:

Location:

Associated Safe Work Permit:

Vessel, Confined Space or Hot Work:

Watchman's Name	Name of Worker Entering	Time In	O_2 (19.5-23% is acceptable)	LEL (Must not exceed 20% of LEL)	H_2S (Goal is 0, must not exceed 10ppm)	Time Out	Initials	
							Watchman	Worker

PIERIDAE ENERGY

Form – 23

Vehicle Inspection Checklist

Unit #:	(If contractor there will be no unit #)
Driver:	
Facility/ Field	
Date:	

Driver	
☐	Driver's license (required)
☐	Registration card (required)
☐	Insurance card/pink card (required)
☐	TDG Exemption Permits or placards (required in production operator vehicles)
☐	HSE Program (required in production operator vehicles)
☐	Corporate ERP and/or Site Specific ERP and/or Phone Lists

Safety Equipment	
☐	Cell phone and/or radio (required)
☐	Fire extinguisher (required in production operator vehicles)
☐	Respiratory equipment/breathing air (as required for applicable operating area in production operator vehicles
☐	First aid kit (required in production operator vehicles, minimum Type 1 Kit)
☐	Flashlight – all weather, intrinsically safe (required in production operator vehicles)
☐	Survival kit – may include: water, food, stove/fuel, waterproof matches, candles and hot packs (optional – as deemed appropriate for applicable operating area)
☐	Suitable Clothing (i.e. be prepared for conditions)

Other Equipment – List of Tools Required for Production Operator Vehicles

- Ditch Hitch Tow kit
- Booster cables 20'
- Emergency flares (triangle reflectors 3 in a kit)
- LED Flashlight
- Ratchet Straps (x2)
- Cell Phone Booster System
- 30lb Fire Extinguisher C/W Bracket
- Pipe wrench 18" Aluminum
- Pipe wrench 24" Aluminum
- Crescent Wrench 12"
- Crescent Wrench 15"
- Vice Grips 10"
- Pliers Water Pump 12"
- Needle Nose Pliers 8"
- Side Cutter Pliers 7"
- 14 piece Combination Wrench Set (3/8" to 1")
- Hammer (Brass 5lb)
- Hammer (Ball-peen 2lb)
- Wire Brush
- Pry Bar 16"
- Allen Key Set (SAE)
- Assorted 1/2" Drive Socket Set (3/8" to 1")
- Assorted 3/8" Drive Socket Set (1/4" to 7/8")

Vehicle Inspection Checklist

- Screwdriver Set 10 Piece
- Long Handle Round Spade
- Axe
- Garden Rake
- Baker Pump
- Wajax
- Cargo Net
- Packing Puller
- Two Way Radio for Vehicle

Vehicle Operation Equipment (operational check)			
☐	Headlights	☐	Windshield condition
☐	Tail lights	☐	Windshield washer fluid level
☐	Brake lights	☐	Oil level
☐	Back up lights	☐	Fuel level
☐	Signal lights	☐	Tire condition and spare tire
☐	Windshield wipers	☐	Seatbelts

Comments