

11. EMERGENCY PLANNING AND REQUIREMENTS FOR SOUR WELLS 1

11.1	Emergency Planning.....	1
11.1.1	Emergency Response Plan For Wells.....	1
11.1.1.1	General.....	1
11.1.1.2	Drilling, Completion and/or Servicing Operations.....	2
11.1.1.2.1	Procedures For Plan Preparation.....	2
11.1.1.2.1.1	Type of Plan.....	2
11.1.1.2.1.2	Local Public Involvement.....	4
11.1.1.2.2	Contents Of An Emergency Response Plan.....	4
11.1.1.2.2.1	Summary Information.....	5
11.1.1.2.2.2	Emergency Definition and Action.....	5
11.1.1.2.2.3	Responsibilities of Company Personnel.....	6
11.1.1.2.2.4	Government Agency Roles and Responsibilities.....	8
11.1.1.2.2.5	Evacuation and Sheltering Plan.....	9
11.1.1.2.2.6	Ignition Procedures.....	13
11.1.1.2.2.7	Additional Public Protection Measures.....	13
11.1.1.2.2.8	Post Emergency Procedures.....	15
11.1.1.2.2.9	Emergency Equipment List.....	15
11.1.1.2.2.10	Contact Lists.....	15
11.1.1.2.2.11	Residents' Information.....	16
11.1.1.2.2.12	Maps - Emergency Response Plan.....	17
11.1.1.2.2.13	Forms.....	17
11.1.1.2.3	Corporate Plan.....	18
11.1.2	Emergency Response Plans for Facilities and Pipelines.....	19
11.2	Requirements for Sour Wells.....	20
11.2.1	Application Requirements - All Wells.....	20
11.2.1.1	Introduction.....	20
11.2.2	Potential H ₂ S Release Rate Determination.....	20
11.2.2.1	Introduction.....	20
11.2.2.2	Drilling/Completion/Servicing H ₂ S Release Rate.....	21
11.2.2.3	Suspended/Producing H ₂ S Release Rate.....	21
11.2.3	Minimum Separation Distance Requirements.....	22
11.2.3.1	Introduction.....	22
11.2.3.2	Application Requirements.....	22
11.2.4	Special Sour Wells.....	23
11.2.4.1	Introduction.....	23
11.2.4.2	Reclassification - Special Sour Wells.....	23
11.2.4.3	Special Sour Well Licensing Requirements.....	23
11.2.4.3.1	Drilling Plan - General.....	24
11.2.4.3.1.1	BOP Stack.....	24
11.2.4.3.1.2	Rig Inspection.....	25
11.2.4.3.1.3	Kick Detection.....	25
11.2.4.3.1.4	Monitoring for H ₂ S Contamination of the Drilling Fluid.....	26
11.2.4.3.1.5	Ambient H ₂ S Detection.....	26
11.2.4.3.1.6	Drill Pipe.....	26
11.2.4.3.1.7	BOP Manifold.....	27
11.2.4.3.1.8	Mud-Gas Separators (Degassers).....	27
11.2.4.3.1.9	Drill String Valves.....	27
11.2.4.3.1.10	Intermediate Casing.....	27
11.2.4.3.1.11	Personnel.....	28
11.2.4.3.1.12	Surveys.....	28

11.3 Definitions.....29

11. EMERGENCY PLANNING AND REQUIREMENTS FOR SOUR WELLS

11.1 Emergency Planning

The Oil and Gas Commission (OGC, “the Commission”) regulates oil and gas exploration, development, production and pipelines in B.C. Its mandate includes a responsibility to ensure that operations and practices are conducted in a safe and environmentally sound manner. The primary authorities under which the Commission regulates oil and gas activity are the [Oil and Gas Commission Act](#), [Petroleum and Natural Gas Act \(P&NG Act\)](#), [Drilling and Production Regulation \(D&P Regulation\)](#), [Pipeline Act](#), [Pipeline Regulation](#), and the [Sour Pipeline Regulation](#) which include provisions directly related to the safe conduct of operations and the prevention of uncontrolled or inappropriate releases of fluids to the environment. These provisions are augmented by other agencies and legislation to ensure the adequate protection of the public and environment. These legal requirements should, however, be considered the minimum or basic requirements. Operators are expected to implement or employ such other measures, techniques or practices that they consider desirable or necessary to manage risks.

The Commission has developed an emergency management plan to guide and co-ordinate its activities in oil or natural gas related emergency situations. Operators may also be required to prepare emergency response plans for specific wells and facilities if such plans are considered necessary. These plans should include detailed procedures and communication information and be presented in a clear and convenient format to ensure that emergencies are handled in an appropriate manner.

11.1.1 Emergency Response Plan For Wells

11.1.1.1 General

Legal authority for requirements related to the safe conduct of operations of wells and facilities and the prevention of waste and spillage is contained in various sections throughout the *P&NG Act*, *Pipeline Act*, *D&P Regulation*, *Pipeline Regulation* and *Sour Pipeline Regulation*. [Section 58 \(1\)](#) of the Drilling and Production regulation requires the submission of an “outline of emergency procedures” for operations related to wells or production facilities, if the hydrogen sulphide content of the gas exceeds 10 mol/kmol or has the potential to impact public health and safety or cause environmental damage. [Section 5](#) of the Sour Pipeline regulations requires that “each company that has a sour pipeline must, before the sour pipeline is open for service, prepare and implement for the sour pipeline an emergency response plan that has the approval of the chief inspecting engineer.”

If an employee of the Commission (or designate) considers that special safety precautions, such as the preparation of an emergency response plan, are necessary for other reasons, he/she may authorize a well contingent on these requirements. For example, an emergency response plan may be required for a well if:

- the well is to be drilled near a populated area and there is a probability of encountering H₂S gas;
- the well is near a populated area and will be drilled into a reservoir whose content is unknown; or
- a well is close to heavily used public facilities.

11.1.1.2 Drilling, Completion and/or Servicing Operations

The following guidelines are for the preparation of emergency response plans for wells designated as requiring site-specific emergency response plans (Refer to [section 11.2](#), Requirements for Sour Wells, for well application and other requirements for sour wells. [Section 11.2.4](#) provides a summary of drilling plan requirements for special sour wells). These requirements apply for drilling, completion and servicing operations for all wells. However, if a producing well is already included as part of a Facility/Pipeline emergency response plan a site-specific emergency response plan may not be required for workover or re-completion operations provided that the size of the emergency planning zone will not be increased as result of the operations and the facility plan has been updated in the past 6 months.

11.1.1.2.1 Procedures For Plan Preparation

11.1.1.2.1.1 Type of Plan

The type of emergency response plan for a sour well depends on the magnitude of the potential H₂S release and/or the number of people in the area who might be affected.

The first step in determining the required type of emergency response plan is to determine the H₂S release rate during drilling and/or completions. The potential release rate determines the size of the emergency planning zone (EPZ). Reference should be made to the CAPP “H₂S Release Rate Assessment Guidelines and Audit Forms” when determining release rates.

Equations 11.1 through 11.3 or Figure 11-1 may be used to define the size of the emergency planning zone. These equations and the graphs are approximations to the Gaussian dispersion equation for steady state releases.

Equation 11.1 $EPZ = 2.0 \times Q_{H_2S}^{0.58} \text{ (km)}$ $Q_{H_2S} < 0.3 \text{ m}^3/\text{s}$

Equation 11.2 $EPZ = 2.3 \times Q_{H_2S}^{0.68} \text{ (km)}$ $0.3 \text{ m}^3/\text{s} \leq Q_{H_2S} < 8.6 \text{ m}^3/\text{s}$

Equation 11.3 $EPZ = 1.9 \times Q_{H_2S}^{0.81} \text{ (km)}$ $Q_{H_2S} \geq 8.6 \text{ m}^3/\text{s}$

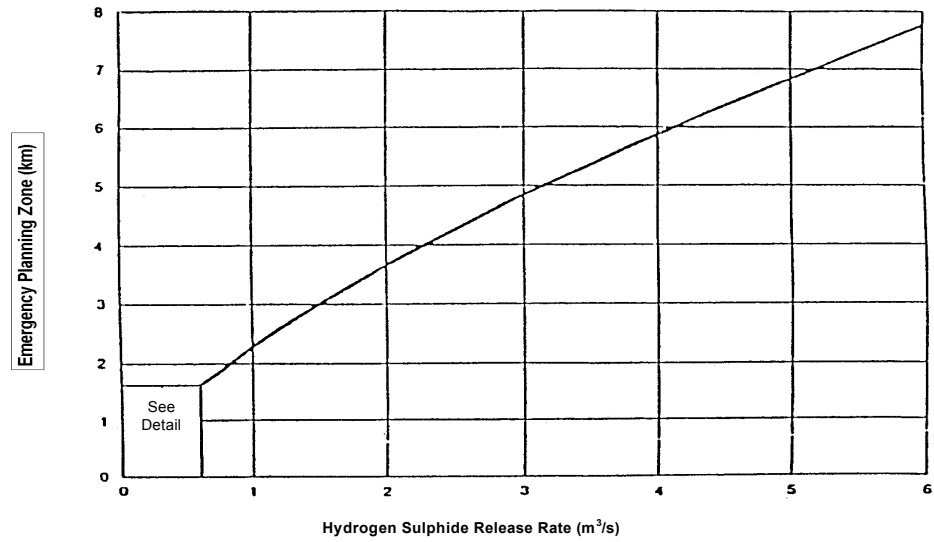
Where there are no permanent residences within the minimum 100 metres of the proposed wellsite and the potential release rate is less than 0.01 m³/sec, there may be no need for a site-specific emergency response plan.

This guideline has identified three types of plans:

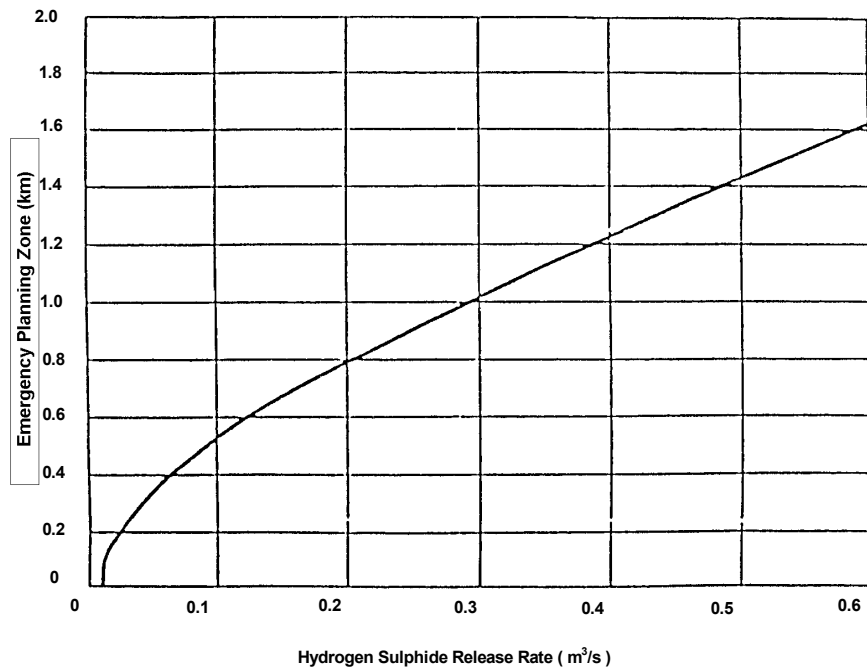
1) Corporate Plan

Where there are no permanent residences, public facilities, or places of business within the emergency planning zone, a corporate emergency response plan may be accepted. The corporate plan should be filed with and approved by the Commission, and should outline internal procedures for addressing emergency situations. The requirements for a corporate plan are described in [section 11.1.1.2.3](#)

Figure 11-1 - EMERGENCY PLANNING ZONE GUIDELINES FOR SOUR WELLS



EMERGENCY PLANNING ZONE GUIDELINES For sour wells



EMERGENCY PLANNING ZONE GUIDELINES For sour wells

2) Site-Specific Emergency Response Plan

Where the number of residences, public facilities, places of business, or similar activities within the emergency planning zone is greater than or equal to one, a site-specific emergency response plan is required, as described in [section 11.1.1.2.2](#) under “Contents of an Emergency Response Plan” of these guidelines.

3) Special Plan

Where there are a significant number of people in the area who could be affected by an H₂S release or a well has the potential to release greater than 2.0 m³/s of H₂S, a well will be classified as special sour. These wells will require a site-specific plan and a *detailed drilling plan* ([section 11.2.4.3.1](#) “Drilling Plan-General”) to be submitted to and approved by the OGC prior to a well authorization being issued ([section 11.2.4](#) “Special Sour Wells”).

11.1.1.2.1.2 Local Public Involvement

An essential part of preparing an emergency response plan is discussions with local residents and the public in the emergency planning zone. The company should prepare and distribute a short version or "Residents' Package" ([section 11.1.1.2.2.11](#) Residents' Information) during initial contact with the residents, public facilities and places of business inside the EPZ. This information package should convey relevant information toward public safety. In some cases, public meetings may be required to exchange information and ideas. The OGC [Public Involvement Guideline](#) should be referenced for specific details on who should be consulted.

A section of the plan shall contain a list of all residents, public facilities and places of business in the emergency planning zone that would be evacuated in the event of an emergency. Relevant information, including any special medical or other factors, should be determined for each residence. Such information is generally best obtained by personal contact with each household and must be treated as confidential.

It is not necessary to provide each resident with a copy of the entire emergency response plan, but in some cases residents may request a copy. Copies of emergency plans given to the public should not contain any personal or confidential information such as unlisted home telephone numbers or personal medical problems.

11.1.1.2.2 Contents Of An Emergency Response Plan

Emergency response plans should be prepared in a format to facilitate changes as required. Information on the following areas must be included;

- Summary Information
- Emergency Definition and Action
- Responsibilities of Company Personnel
- Government Roles and Responsibilities
- Evacuation and Sheltering Plans
- Ignition Procedures
- Additional Public Protection Measures
- Post Emergency Procedures
- Emergency Equipment List
- Emergency Contact Lists
- Residents Information
- Maps – Emergency Response Plan
- Forms

11.1.1.2.2.1 Summary Information

The following summary information should be placed near the beginning of the plan for quick reference.

- 1) Essential information in the plan including:
 - location of the well (legal location name, nearest town and main response centres);
 - potential H₂S release rate;
 - topographic setting, land use and population;
 - company and OGC 24 hour telephone numbers

11.1.1.2.2.2 Emergency Definition and Action

This section should identify the definitions of an emergency and their related actions. Three levels of emergency will be identified. The levels are in ascending order of potential hazard to the public.

Levels of Emergency and Action Plans

Level 1 Emergency: Potential Emergency

There is no immediate danger to the public or environment as no H₂S has been released; the emergency is confined to the lease or company property. Creates little or no media interest. Level 1 emergency could include:

Sour zone is open and any of the following is occurring,

- pipe or tool stuck in the hole
- lost circulation or inability to circulate
- H₂S or soluble sulfides detected at surface in the drilling fluids
- Influx of sour formation fluids

Level 1 Action Plan

- Alert all well site personnel. Evaluate problem and initiate appropriate remedial action.
- Unnecessary personnel to leave the site.
- Notify company representative(s).
- Alert mobile monitoring equipment to be ready for a callout or mobilize monitoring equipment if location is remote.
- Advise OGC's office in Fort St. John.
- Advise local provincial emergency program representative (PEP).
- In some cases, where there are large numbers of residents, notify or evacuate residents in accordance with the site-specific plan.
- Prepare for evacuation in case of escalation of the situation.

Level 2 Emergency: Emergency

There is the potential for risk to the public or environment, as the emergency could extend beyond Company property. However, control is still possible. Creates local or regional media interest. Level 2 emergency could include the following examples:

- incomplete combustion of hydrogen sulphide at the flare pit,
- equipment malfunction that hinders well control while circulating a kick,
- inability to maintain required volumes of circulation material.

Level 2 Action Plan

- Ensure all level 1 actions are taking place;

- Initiate evacuation of emergency planning zone (see [section 11.1.1.2.2.5](#) under Evacuation and Sheltering Plan);
- Set up roadblocks to isolate the EPZ;
- Notify OGC office in Fort St. John, which will in turn request the provincial emergency program to advise other government agencies;
- Discuss issuance of a closure order with the OGC's head office at Fort St. John;
- Send out monitoring crew; initiate mobile monitoring;
- Send company representative to reception centre;
- Inform senior company personnel;
- Establish communications links to off-site control centre;
- Assemble ignition crew and ready ignition equipment in case of escalation of the situation.

Level 3 Emergency: Major Emergency

There exists an immediate danger to the public or environment; control of the situation has been lost. Creates Provincial or National media interest. Level 3 emergency could include the following:

- Uncontrolled flow (i.e. a gas flow which cannot be shut off at operator's discretion) from the well;
- H₂S readings have reached 15ppm, over a 15 minute time weighted average, at the nearest unevacuated residence.

Level 3 Action Plan

- Ensure all level 1 and 2 actions are taking place.
- Mobile monitoring equipment in place
- Ignite release if any of the ignition criteria are met.
- Advise OGC and PEP of the state of the emergency.
- Expand EPZ as required.

11.1.1.2.2.3 Responsibilities of Company Personnel

A description of the responsibilities of each of the emergency response personnel is required.

Each position must be assigned a backup or alternate who has been trained to assume the duties of that position if necessary. The following duties, as a minimum, must be assigned to designated personnel. The following titles have been provided as examples only companies may choose alternate titles.

- 1) Supervisor of Emergency Operations (i.e. Drilling/Completions Manager)
 - Provides overall supervision of emergency response and assures response plan requirements are met.
 - Mobilizes (as required) and is in communication with all other supervisory emergency personnel.
 - Provides assistance in determining whether ignition is required.
 - Ensures all emergency personnel are informed of the alert status.
 - Ensures OGC and RCMP have been notified and requested to call other government agencies.
- 2) On-Site Supervisor (Drilling/Completion Supervisor)
 - Supervises well control.
 - Ensures safety of on-site personnel.
 - Responsibility to direct ignition if ignition criteria are met.

- Keeps supervisor of emergency operations informed of on-site activities and equipment needed.
 - Requests outside assistance and equipment as required.
 - Maintains liaison with on-site OGC, Workers' Compensation Board and Ministry of Water, Land and Air Protection representatives.
- 3) Rig Manager
- Supervises personnel involved in well control operations.
 - Informs on-site supervisor of outside assistance or equipment required.
- 4) Safety Personnel
- Advises the drilling/completion supervisor of safety requirements.
 - Sets up, deploys and maintains medical, fire, breathing and resuscitation apparatus, H₂S and SO₂ portable hand-operated and continuous monitoring equipment and audible alarm system.
 - Ensures rig crews, other personnel on well site have the necessary breathing apparatus, first aid qualifications (including H₂S casualty resuscitation techniques) and casualty rescue training.
 - Controls and records the movement of all personnel to and from the well site; ensures that safety rules are met and that proper protective equipment is worn as required.
- 5) Evacuation Coordinator
- Coordinates the following:
 - Air quality monitoring
 - Evacuation of the public from the EPZ
 - Contact of residents to evacuate by telephone and in person
 - Dispatches reception centre representative
 - Directs checking of emergency planning zone for transients and ensures their evacuation
 - Roadblocks to isolate the EPZ
 - Updates on-site supervisor with status of air monitoring and evacuation activity
- 6) Telephoners
- Telephones residences, public facilities and place of business within the emergency planning zone and requests that they evacuate. A prepared statement should be used (See Fig. 11-2).
- 7) Evacuation Crews
- Patrols EPZ.
 - Assists public with evacuation, where required.
 - Checks each residence, public facility and place of business to ensure successful evacuation.
 - Reports evacuation status to evacuation coordinator.
- 8) Air Monitoring Crews
- Performs air quality monitoring with hand-held aspirating detectors until mobile air monitoring unit arrives.
 - Tracks plume and attempt to find maximum concentrations.
 - Checks unevacuated areas to ensure evacuation criteria have not been exceeded outside the EPZ.
 - Records measured concentrations, including times and locations of readings.
 - Reports findings to evacuation coordinator with special emphasis on concentrations exceeding ignition criteria.

9) Reception Centre Representative

- Proceeds to reception centre.
- Checks in residents, and members of the public.
- Records destination of residents/public who have checked in.
- Provides for comfort of residents/public and answers questions.
- Keeps evacuation coordinator advised of public registration status.
- Refers media inquiries to operator's spokesperson.

10) Public Relations

- Acts as operator's spokesperson for the media and the general public.
- Releases prepared statements regarding the emergency.
- Answers questions and provides requested information to the media.

11.1.1.2.2.4 Government Agency Roles and Responsibilities

The assistance that is to be provided by the provincial government agencies and local authorities must be identified in the plan. ***During plan preparation, discussion must be held with the applicable agencies to agree on responsibilities and the type of assistance that can be provided.***

The following is a list of agencies that might be consulted in developing the plan:

- RCMP (local detachment);
- [Oil and Gas Commission](#), Fort St. John;
- British Columbia Provincial Emergency Program ([PEP](#));
- British Columbia [Ministry of Water, Land and Air Protection](#);
 - Fish and Wildlife Branch;
 - [Pollution Prevention Branch](#);
- Local Municipal Government/First Nation;
- British Columbia [Ministry of Forests](#), Forest Service;
- [Workers' Compensation Board](#) of British Columbia;
- British Columbia [Ministry of Transportation](#);
- Local fire department;
- Hospitals and ambulance services;
- [Local health units](#).

The plan should identify the role (if any) of each government agency and which agency will receive a copy of the site-specific plan.

The following agencies should receive a copy of all plans:

- Oil and Gas Commission, Fort St. John
- Provincial Emergency Program
- RCMP (local detachment)
- Ministry of Water, Land and Air Protection, Regional Office
- Local health unit
- Workers' Compensation Board

11.1.1.2.2.5 Evacuation and Sheltering Plan

An important function of the emergency response plan is to provide a procedure to evacuate or shelter members of the public whose safety may be threatened. Each plan should clearly set out both the criteria and procedures for evacuation and sheltering.

Evacuation Criteria

This section of the plan should set out the company's proposed criteria to initiate the evacuation procedures. The factors to consider are:

- level of emergency
- conditions at the well site and if they are likely to escalate to a more serious situation,
- residents sensitivities and/or medical conditions,
- the levels of H₂S reaching the public outside the EPZ.

A level 2 emergency dictates mandatory evacuation of all public from the emergency planning zone. Evacuation of members of the public outside the EPZ is mandatory when H₂S levels reach 10ppm if safe to do so.

Evacuation Procedures

Once a decision is made to evacuate the EPZ, the plan must provide for the residents, public facilities, places of business and transients to be contacted.

The procedures, which will be used to protect the safety of the public through evacuation of the EPZ, must be described in detail. These procedures must comply with the requirements for one or more of the cases outlined below, as applicable.

- 1) Residences, public facilities and places of business within the emergency planning zone:
 - there should be individuals assigned for telephone notification (ideally one telephoner per seven contacts);
 - a prewritten statement of information to be read to the contacts is strongly recommended (See Fig. 11-2);
 - a summary sheet for each evacuation crew may be useful (See Fig. 11-3);
 - evacuation crews in patrol vehicles must be dispatched immediately upon initiation of informing residents to evacuate in order to assist residents in evacuating and to ensure that an effective evacuation is taking place.
- 2) Registered traplines, hunting and guiding operations in the emergency planning zone:
 - arrangements to search trapline, hunting and guiding areas, and to communicate with them by use of a helicopter equipped with a loudspeaker or by other means ;
- 3) Non-residents within the emergency planning zone:
 - procedures for evacuating the following groups of non-residents must be included in the plan.
 - itinerant workers, i.e. loggers, prospectors, government personnel, operators of other oil and gas facilities;
 - public facilities, i.e. schools, hospitals, churches, recreation areas including campgrounds, community halls;
 - places of commercial activity, i.e., auction mart, corner store;
 - recreation itinerants such as hikers, hunters, fishermen, skiers, etc.;
 - arrangements to search the area, such as by use of a helicopter equipped with a loudspeaker;

Figure 11-2 - SAMPLE EVACUATION NOTIFICATION

In the case of a telephone contact, the following "standard notification text" summarizes what should be said:

DATE: _____

TIME: _____

SIGNATURE OF CALLER: _____

STANDARD NOTIFICATION TEXT

Mr. (Mrs.) _____, this is (Company Name) calling from _____. We have a well control problem at the nearby _____ drilling location. If a release occurs, the wind could carry the gas to the _____. You are in no immediate danger, however, we request that you evacuate your premises within the next _____. How many person are at your house presently? Do you have transportation? (If not, please stay indoors, we will send an evacuation vehicle immediately.) If you have transportation, please take the north/east/south/west route. Please report to the _____ to confirm your evacuation. We will have people there to receive you. After reporting to _____, you will be free to go where you please or we will make arrangements for your accommodation. Any concerns you have regarding livestock, pets or property will be addressed by our representative at _____.

In addition, the following information would be recorded by the person notifying the resident:

NAME: _____

ADDRESS/DIRECTIONS: _____

NUMBER OF PERSONS AT RESIDENCE NOW: _____

TRANSPORTATION REQUIRED _____

MEDICAL CONSIDERATIONS: _____

(The above information is only for the purpose of confirming the information obtained at the time of the initial visit by the Company representative.)

Figure 11-3 - PHONES AND SAFETY ASSISTANTS NOTIFICATION PROCEDURE

Telephone Assistant #2 Contact List

Area “B”

Resident Surname	Evacuation Transport		Contacted Yes or No	Time Contacted	Route N or S	Required Yes or No	Number of Occupants	Remarks Note any Problems
	Map Number	Residence Telephone						
Smith	Z-1	555-1234	_____	_____	_____	_____	_____	_____
Jones	Z-2	555-2345	_____	_____	_____	_____	_____	_____
Wong	Z-3	555-3456	_____	_____	_____	_____	_____	<u>Occasional Resident</u>
Nelson	Z-4	555-4567	_____	_____	_____	_____	_____	_____
Young	Z-5	555-5678	_____	_____	_____	_____	_____	<u>Occasional Resident</u>

- adequate transportation (i.e. school buses) to be arranged to evacuate public facilities - all other non-residents may be evacuated through use of the patrol vehicles.
- 4) Residences within an incorporated municipality:
- an area within the emergency planning zone which is within an incorporated municipality and contains a large number of residences might best be evacuated solely by use of the municipal and/or provincial emergency plans (discussed below);
 - for such a case, the residents' visitation information and handout may be provided to the Emergency Program Emergency Coordinator.
- 5) Residents outside the emergency planning zone:
- Municipality/Local Authority and/or PEP responsibility.
 - Company must provide for air monitoring at the nearest downwind unevacuated residence.

All municipalities are required to prepare a local emergency plan. These plans all contain evacuation and reception procedures. The evacuation assistance, which would be provided by the local authorities, would be determined in the initial discussion prior to plan preparation and be included in the plan.

The evacuation area will be expanded in areas where monitored H₂S and/or SO₂ concentrations exceed the evacuation levels and/or resident health effects are apparent. If an uncontrolled release is ignited to protect the public, continuous monitoring for SO₂ or H₂S of the surrounding area would determine if public evacuation becomes necessary.

Sheltering Criteria

Sheltering is a Canadian Standards Association recognized public protection method. Residents and business people should be sheltered during the following circumstances:

- There is not enough time or warning to safely evacuate the public who is potentially at risk.
- The public would be at a higher risk because of evacuation.
- The buildings are considered to be within or near to toxic or explosive gas plumes.
- Escape routes traverse the hazard.
- The duration of the release is short.

Sheltering should be of a short duration, several minutes to half an hour.

The operator should maximize the safety of the sheltered residents by following these precautions:

- Initiating ignition procedures if any ignition criteria are met.
- Containing the release.
- Initiating evacuation procedures if conditions are determined to be safe.

Sheltering Procedures

Residents and business people should be telephoned and advised to shelter. The Telephoners should provide the following instructions to sheltered residents:

- Close all windows and doors.
- Shut off all air intake fans which exhaust outdoors, e.g. clothes dryers, stove vents, vacu-flo systems and bathroom fans.
- Turn off heat and hot water pilot lights.
- Extinguish fires in fireplaces.
- Wait in an upstairs interior room of the house for further instructions.

The Telephoners should provide contact telephone numbers to sheltered members of the public and will frequently telephone with updates. It is important to reassure sheltered

members of the public that they have not been forgotten and that sheltering is the safest action at this time.

11.1.1.2.2.6 Ignition Procedures

The senior on-site company representative must have the authority for ignition of an uncontrolled flow. If time allows a decision on ignition will be made in consultation with the OGC. The criteria for ignition are as follows:

Ignition Criteria

The well must be ignited as soon as all personnel working at the site have cleared to a safe distance under any of the following conditions:

- 1) The well is experiencing an uncontrolled flow, the well effluent has reached the surface, no immediate chance of control and the flow, if not ignited, could lead to loss of life.
- 2) The well is flowing sour gas to surface and safety of residents cannot be assured because:
 - evacuation of residents within the emergency response planning zone **CANNOT** be accomplished; or
 - monitoring results indicate H₂S levels of 15 ppm for 15 minutes in unevacuated areas; or
 - monitoring is not taking place due to some unforeseen circumstances, such as bad weather or communication breakdown.
- 3) For special sour wells, as determined by OGC, immediate ignition of a well may be required.

Ignition Procedures

Each plan should describe the procedures to be followed by well site personnel to ignite an uncontrolled flow. This is a hazardous operation and the procedures must recognize the safety of both on-site personnel and the public.

11.1.1.2.2.7 Additional Public Protection Measures

Roadblocks

To protect the public from entering the emergency planning zone, manned roadblocks must be set up and maintained on all access roads. The operator must also consider navigable waters and/or railways or other types of transportation that may access the EPZ.

Roadblocks should be set up and manned in conjunction with the RCMP and/or Ministry of Transportation. During plan preparation, the local RCMP detachment, Ministry of Transportation - District Highway Manager and Railways must be contacted with regard to availability of personnel and the response that can be provided.

Communication must be available between all roadblock locations and command posts. The roadblock locations must be marked on the map and numbered or lettered.

Suggested Roadblock Equipment:

- H₂S detection equipment (handheld instruments);
- Explosive gas detectors;
- radio communication - with on-site command post and air monitoring units;
- poisonous gas signs;

- road barriers;
- maps;
- reflective triangles
- flashlights (with batteries)
- checklists (names, times, etc.) of people leaving and entering,
- Handheld stop signs
- Personal Protective Equipment,
- Flares and/or Flashing lights

Air Monitoring

Air monitoring equipment may be required during drilling, servicing and completing sour wells depending on the type of emergency response plan applicable in each case.

Ambient H₂S and SO₂ monitoring should be initiated as part of the level 2 and level 3 response. Mobilization of the air monitoring equipment may be required at level 1 if there is a possibility that the situation may deteriorate and the travel time to the location is significant. Air monitoring should include procedures for locating and following the plume, checking for hazardous concentrations at local residences, and recording the measured H₂S and SO₂ concentrations. For a level 2 or level 3 emergency where a release has the possibility of being sustained, the hazard area must be redefined using mobile monitoring vehicles. These vehicles must be equipped with devices to continuously measure and record wind speed and direction and H₂S and SO₂ concentrations to accurately establish 3-minute average concentrations.

Reception Centre

A reception centre should be arranged to which evacuated persons will be sent and a company representative appointed to receive evacuees at the centre. The role of that representative would be to register evacuees as they arrive, make arrangements for their comfort and well being, answer questions they may have, and record where persons leaving the centre may be contacted. All residents, workers, and non-resident persons should be instructed to report to the reception centre.

Communications

Well-planned communications procedures and equipment must be utilized. The plan should specify initial communications immediately following an operational emergency and communication links after the plan is initiated.

Communications must be provided at the following locations:

1) On-Site Command Post:

- location of well control coordinator and well control operations;
- location of company representative at site of emergency;
- required representative from OGC;
- other selected government agencies, as required.

2) Off-Site Control Centre:

- provides support to on-site command post;
- location of evacuation coordinator;
- contains company public relations representative (i.e. local field office; gas plant control room);
- government representatives gather at off-site control centre.

3) Head Office:

- may be off-site control centre where appropriate;
- location of senior company personnel.

4) Roadblock, Evacuation, Air Monitoring Personnel:

- communication link established with roadblock, evacuation, air monitoring personnel and the appropriate command post(s).

11.1.1.2.2.8 *Post Emergency Procedures*

The decision to return residents to the area and to resume work in the evacuated area will be declared by the OGC EOC Incident Commander in consultation with the regional representatives of Provincial Emergency Program and the operator.

The operator's plan should describe these procedures for the guidance of emergency response personnel.

11.1.1.2.2.9 *Emergency Equipment List*

A list of emergency equipment and the locations of this equipment must be provided. This list must include:

1) Communication Equipment:

- number and locations of telephones, identifying dedicated lines;
- number and locations of mobile telephones; and
- radio equipment.

2) Field-Based Equipment:

- number of field vehicles - emergency equipment contained in each;
- H₂S detection (i.e. hand aspirators);
- all self-contained breathing apparatus (positive pressure) and breathing air and oxygen supplies and a bottle recharging system;
- first aid equipment (includes resuscitators);
- primary ignition equipment and alternate back-up systems.

3) Dedicated Evacuation Vehicles:

- number and location of evacuation vehicles;
- emergency equipment contained in each.

4) Other Emergency Equipment:

- contract service equipment;
- mobile H₂S and SO₂ detection;
- standby wind speed and direction monitoring device complete with continuous recorder;
- standby helicopter equipment - description, contractor and location;
- standby ambulance - description, contractor and location.

11.1.1.2.2.10 *Contact Lists*

Contact lists should be prepared as follows:

1) Resident Contact List

This list should identify all residents in the emergency planning zone. It should give their phone number, location and any special information needed to quickly and safely evacuate them.

2) Company Contact List

All relevant oil company and drilling operator personnel should be identified by name with alternates for critical functions.

3) Government Contact List

A list of relevant government agencies and their 24 hour phone numbers should be included.

4) Other Phone Numbers

It may be useful to emergency response personnel to also have a list of other helpful contacts. For example, air monitoring specialists, well control specialists, safety supply companies, aircraft services, forestry firefighting services, heavy equipment suppliers and other relevant service companies.

11.1.1.2.2.11 Residents' Information

Information should be obtained through visits by representatives of the operator to each residence within the emergency planning zone. The representative should provide information regarding the potential for a sour gas occurrence, the approximate time after drilling commences that sour gas zones would be penetrated, the possibility, however remote, of a hazardous situation, the potential effects and evacuation procedures. The companies response actions should be reviewed. Input from the residents should be considered.

The following information must be requested or confirmed for each residence:

- location of residence;
- family surname, address, telephone number, business number;
- number of residents;
- existing health problems, especially if respiratory;
- need for assistance or transportation during evacuation.

Any personal information (such as health problems, unlisted telephone numbers, or children's ages) obtained from the residents should be clearly marked as confidential in the copies of the emergency response plan. This information must be provided to any company personnel involved in evacuation procedures.

Residents' Package

Residents must be provided with a document containing the following information, as a minimum:

- company name, company contact and 24 hr emergency contact number;
- location of the well;
- approximate timing of well operations;
- explanation of the potential hazards of an uncontrolled release of H₂S and SO₂;
- description of potential emergencies and operator's response plans;
- characteristics and dangers of H₂S and SO₂ (samples given in Appendix 1 and 2);
- actions if resident suspects H₂S or SO₂;
- explanation of evacuation, sheltering and ignition procedures;
- explanation of evacuation of schools and hospitals and homes for the aged;
- location of reception centre(s);
- Provincial Emergency Program (PEP) 24 hour Emergency Coordination Centre number;
- area map.

A sample residents package must be included in the Emergency Response Plan.

11.1.1.2.2.12 *Maps - Emergency Response Plan*

Two key maps are required with the emergency response plan:

1) Regional Map

This map is intended to show the setting of the emergency planning zone within the context of the larger region, on a suggested scale of 1:250,000:

- well site;
- topography;
- rail lines, airports, roads, lakes and rivers;
- parks, recreation areas;
- cities, towns and villages.

The maximum dimension should preferably be limited to 28 x 43 cm (11 x 17 inches).

2) Emergency Planning Zone Map

This map should show details within the emergency planning zone and the awareness zone, with the residents in the emergency planning zone keyed to the residents' phone list for use during an evacuation. Public facilities and residences (seasonal or otherwise) should be ground truthed to the boundary of the emergency awareness zone (twice the EPZ radius). The map must show:

- the emergency planning zone;
- the emergency awareness zone (twice the EPZ radius);
- public facilities - schools, churches, community halls, hospitals, campgrounds;
- roadblock locations;
- location of trapline boundaries;
- residences within the zones;
- well site;
- trails, roads, major highways, railroads, airports, rivers and lakes;
- all industrial activity sites;
- other information relevant to an emergency.

Preferably the map sheet should be on a scale of 1:20,000 and not be larger than 76 x 122 cm (30 x 48 inches). Inserts to show necessary detail should be used as needed.

11.1.1.2.2.13 *Forms*

Proper documentation is essential during an emergency situation. A written record of events leading up to and throughout the duration of the incident allows company representatives; government officials and contract personnel to work together to make better decisions regarding worker and public safety. This information is also vital to subsequent investigations into cause, to satisfy government reporting requirements as well as a learning tool for improving emergency response. Pre-formatted forms are a good way of capturing this critical information. Some examples of types of forms to consider include:

- Incident notification
- Time and event log
- Incident status update
- Evacuee registration record
- Roadblock checkpoint record

- Environmental monitoring record (H₂S, SO₂, etc.)

11.1.1.2.3 Corporate Plan

A corporate plan will be allowed for sour oil or gas wells which meet the criteria described in [Section 11.1.1.2.1](#) (Procedures For Plan Preparation, Plan type).

Generally, this would apply where there are no residences within the emergency planning zone.

The requirements for corporate emergency plans are as follows:

- 1) Procedures must be established to contact and evacuate any trapper(s)/guide outfitter(s) or transients within the emergency planning zone. This may require the use of one or more evacuation vehicles, which must be made available on a 24-hour/day basis, throughout sour operations.
- 2) There must be one driver on site for each evacuation vehicle - these personnel must not be required for well control operations.
- 3) A full internal corporate emergency plan which cover the requirements of this guide (this may be a general plan for all drilling, completion, and servicing operations) must be prepared and available at the well site, and may be requested to be submitted to the Commission for review.

Corporate emergency plans must receive approval from the OGC.

11.1.2 Emergency Response Plans for Facilities and Pipelines

Sections [4,5](#) and [8](#) of the [Sour Pipeline Regulation](#) set out emergency procedures requirements for sour gas facilities and pipelines. The primary purpose of these procedures is to ensure public safety.

As per section 5 of the sour pipeline regulation, an emergency response plan must be prepared in conformity with the guidelines for the preparation and content of a sour gas emergency response plan as published by

- (a) the [Canadian Association of Petroleum Producers](#),
- (b) the [Alberta Energy and Utilities Board](#), or
- (c) the Commission.

Operators should bear in mind when preparing plans in accordance with these guidelines that the OGC may require more stringent or additional features to any proposed plan or may otherwise vary any features of the guidelines depending upon specific circumstances.

11.2 Requirements for Sour Wells

11.2.1 Application Requirements - All Wells

11.2.1.1 Introduction

The OGC expects companies to evaluate the potential of every well to penetrate formations that may contain H₂S and to plan for the drilling of the well according to that potential. Each application for a well license must provide, to varying degrees, the results of that evaluation and the information that is applicable. The aforementioned requirement is met by filling out the “sour wells only” section of the [Application for a Well Authorization and Permission to Construct a Wellsite and Access](#). Although the OGC does not require the applicant to submit all of the supporting documentation it should be kept available and submitted if requested by the OGC.

Supporting documentation should contain the following:

- A discussion and supporting information which establishes the geological setting and potential of the proposed well;
- A discussion and supporting information respecting the H₂S content for each sour zone which may be encountered;
- A discussion and supporting information respecting the flow rates that may be expected from each potentially sour zone;
- Calculation of the combined maximum potential H₂S release rate having regard for the drilling program and design of the well ([section 11.2.2.2](#));

Applications for all well licenses must include one of the following:

- A statement, and supporting evidence if appropriate, to the effect that none of the formations to be encountered during the drilling of the well are expected to contain H₂S, **or**;
- For wells which are expected to encounter sour gas the following is required:
 - The potential H₂S release rate information described in [section 11.2.2](#); and
 - The minimum separation distance information as described in [section 11.2.3](#); and
 - An emergency response plan as described in [section 11.1.1.2.1](#), if applicable; and
 - A special sour well drilling plan as described in [section 11.2.4](#), if applicable.

11.2.2 Potential H₂S Release Rate Determination

11.2.2.1 Introduction

A determination of the maximum potential H₂S release rate forms the basis for further application requirements. It must be calculated from the maximum surface deliverability and the maximum H₂S content that can be reasonably expected. Evaluations should be done using a realistic, responsible engineering approach.

Information used should reflect all data from wells in the area that are considered to be representative of the subject well. It is emphasized that the expected geological setting and therefore potential of the well is very important to this process. It may not, for

example, be appropriate to use adjacent wells if the geological evidence indicates a different potential. The CAPP “H₂S Release Rate Assessment Guidelines and Audit Forms” should be referenced when making these determinations.

For very large release rates operators may wish to apply, in writing, for a reduced EPZ in order to more effectively manage the emergency planning zone area. However, approval will only be given if the Commission is satisfied that such a reduction is warranted and sufficient measures are in place to ensure public safety (i.e. dual ignition system, immediate ignition criteria, etc).

11.2.2.2 Drilling/Completion/Serviceing H₂S Release Rate

The drilling H₂S release rate is used to determine whether an emergency response plan is required ([section 11.1.1.2.1](#)) and whether the well is classified as a special sour well ([section 11.2.4](#)).

Information required includes:

- 1) For each formation to be penetrated which may contain H₂S:
 - The maximum concentration of H₂S that can be expected and the source of that information;
 - The maximum surface deliverability that can be expected against zero backpressure for the casing flow or open-hole flow configuration;
- 2) The maximum potential uncontrolled surface H₂S release rate at that stage in the drilling of the well where the sum of the release rate from each formation open to the wellbore is at a maximum.

11.2.2.3 Suspended/Producing H₂S Release Rate

The suspended/producing H₂S release rate is used to determine the level classification of the well ([section 11.2.3](#)). Where stimulation is normal or expected, a post-stimulation rate should be used.

Information required includes:

- 1) For each formation to be suspended/produced which may contain H₂S:
 - The maximum concentration of H₂S that can be expected, and the source of that information;
 - The maximum surface deliverability that can be expected against zero back pressure, for the tubing flow configuration for a well completed with a packer, or the tubing and annular flow configuration for a well completed without a packer if the well is capable of flowing up the annulus.
- 2) The maximum potential uncontrolled surface H₂S release rate at that stage in the suspended/producing life of the well where the sum of the release rates for each formation open to the wellbore is at a maximum.

11.2.3 Minimum Separation Distance Requirements

11.2.3.1 Introduction

In order to select appropriate well locations having regard for safety and present land-use, the OGC has established the following level classification for sour wells. Each level classification has corresponding minimum separation distances between sour wells and residential and other developments. The distances increase as the suspended/producing H₂S release rate potential ([section 11.2.2.3](#)) increases, and with increasing population density. Table 11-1 summarizes the separation distances required for licensing a sour well. It is worth noting that Municipalities and Regional Districts in British Columbia have not implemented reciprocal setbacks as in Alberta.

Table 11-1 SUMMARY OF MINIMUM DISTANCE REQUIREMENTS SEPARATING PROPOSED SOUR WELLS AND PIPELINES FROM RESIDENTIAL AND OTHER DEVELOPMENTS

Level Classification	Suspended/ Producing Wells, Sour Pipelines	Sour Pipelines*	Minimum Distance from Proposed Well to Various Developments
	H ₂ S Release Rate m ³ /s	H ₂ S Release Volume m ³ or	
1	≥0.01 - <0.3	<300	<ul style="list-style-type: none"> 0.1 km to any surface improvements
2	≥0.3 - <2.0	≥300 - <2000	<ul style="list-style-type: none"> 0.1 km for individual permanent dwellings or unrestricted country development 0.5 km for urban centres or public facilities
3	≥2.0 - <6.0	≥2000 - <6000	<ul style="list-style-type: none"> 0.1 km for individual permanent dwellings 0.5 km for unrestricted country development 1.5 km for urban centres or public facilities
4	≥6.0	≥6000	<ul style="list-style-type: none"> as specified by the OGC, but not less than Level 3

* *Sour Pipeline Regulation* specifies release volumes or release rates.

Note: Any well classified as a Level 1, 2, 3 or 4 sour well may also be classified as a special sour well ([section 11.2.4](#)).

11.2.3.2 Application Requirements

Please reference the [Checklist for a Wellsite](#) application on crown, private or crown and private land to ensure all application requirements have been met.

Public consultation requirements for sour wells are outlined in the [“Public Involvement Guideline”](#), these guidelines should be referred prior to commencing any public consultation.

11.2.4 Special Sour Wells

11.2.4.1 Introduction

The classification of special sour wells is based on two primary criteria, H₂S release rate potential and proximity to populated centres.

For the purpose of this guideline a special sour well is defined as follows:

- 1) Any well from which the maximum potential H₂S release rate is 0.01 m³/s or greater and less than 0.1 m³/s and which is located within 500 metres of the corporate boundaries of an urban centre; or
- 2) Any well from which the maximum potential H₂S release rate is 0.1 m³/s or greater and less than 0.3 m³/s and which is located within 1.5 kilometres of the corporate boundaries of an urban centre; or
- 3) Any well from which the maximum potential H₂S release rate is 0.3 m³/s or greater and less than 2.0 m³/s and which is located within 5 kilometres of the corporate boundaries of an urban centre; or
- 4) Any well from which the maximum potential H₂S release rate is 2.0 m³/s or greater; or
- 5) Any other well which the OGC classifies as a special sour well having regard to the maximum potential H₂S release rate, the population density, the environment, the sensitivity of the area where the well would be located, and the expected complexities during the drilling phase.

11.2.4.2 Reclassification - Special Sour Wells

A sour well, once classified as a special sour well, will retain that classification as long as it is within the “critical time or depth” as defined in [section 11.3](#). As a special well it must meet all of the related operational and safety-related requirements set out by the Commission. However, the OGC will consider applications to remove the “special” designation.

Applications to change the “special” designation assigned to a sour well shall be based on the most recent and complete information available at the time of application.

11.2.4.3 Special Sour Well Licensing Requirements

The following requirements apply to the drilling of a well classified as a special sour well. All special sour wells must submit and have approved by the OGC a copy of the site-specific emergency response plan and drilling program prior to the OGC approving the application for well authorization and permission to construct a wellsite and access.

The applicant for a well license is expected to address each of the following items. However, the amount of detail provided should have regard for the type of well and the risk and consequences of a blowout.

11.2.4.3.1 Drilling Plan - General

A drilling plan must be submitted which provides planning information and details respecting drilling-related equipment and procedures proposed, including but not limited to:

- 1) Geological information, including the extent and quality of offset data, a summary of offset hole problems and adverse drilling occurrences, an assessment of the possibility of encountering similar problems and occurrences at the proposed well, and how the problems and occurrences will be dealt with.
- 2) A description of the equipment that will be used to drill the well including:
 - The BOP system, including a discussion as to whether blind shear rams will be used and if not, an assessment or evaluation of their possible use;
 - Drill pipe;
 - Mud-gas separators;
 - Drilling fluid system and equipment (type, density, quantity, hole volume, surface volume, stockpile supplies and availability, H₂S scavenger, mixing and pumping equipment); and,
 - Wellhead (casing bowl, intermediate spool, valves) and casing (surface, intermediate, production).
- 3) A description of the procedures that will be followed in drilling the well including:
 - Inspection and testing procedures to ensure that all equipment is fully operational prior to the well reaching the critical depth and procedures to ensure that a state of readiness is maintained;
 - Procedures to ensure that wellsite personnel are familiar with the drilling and emergency response plan, trained in the use of the drilling and safety equipment, and are proficient in BOP and well control procedures;
 - Procedures to ensure wellbore and casing integrity (directional survey, formation leak-off tests, casing pressure test, caliper logs);
- 4) A description of the monitoring of drilling and drilling fluid parameters that will be installed to ensure drilling occurrences (kicks, lost circulation) or warning signs (drilling rate, torque, pump pressure, gas-cut mud) are promptly detected; and,
- 5) Information to confirm, prior to licensing that sufficient well-site personnel will be available and they will be adequately trained and experienced for the drilling operation.

11.2.4.3.1.1 BOP Stack

- 1) Minimum stack components shall consist of an annular preventer, two spools, and three rams except for maximum projected depths less than 1850 m, flanged side outlets on the lower ram preventer may be substituted for the lower drilling spool. The configuration of the BOP stack shall conform to IRP 1 – Critical Sour Drilling;
- 2) All pressure containing components of the BOP stack, inclusive of attached valves and choke lines through to the outside valves of the choke manifold, with the potential to be exposed to H₂S gas shall be constructed of materials which meet the standards of the National Association of Corrosion Engineers (NACE) MR-01-75 (latest revision);
- 3) The BOP master control shall be installed at a location remote from the rig floor;

- 4) Welded casing bowls shall be welded in accordance with an acceptable welding procedure developed from Appendix 8 of API Spec. 6A, Specification for Wellhead and Christmas Tree Equipment, NACE MP-01-75, and section IX of ASME, Boiler and Pressure Vessel Code;
- 5) Threaded casing bowls shall be manufactured in accordance with API Spec. 6A, the make-up procedures and torque in accordance with API RP 5C1, Care and Use of Casing and Tubing, and the thread compound used in accordance with API Bul 5A2, Bulletin on Thread Compounds;
- 6) Drilling components installed between the top flange of the upper most blowout preventer and the rig floor shall be constructed to permit their removal and installation of flanged equipment compatible with the existing BOP stack while drill pipe or other equipment is in the hole.

11.2.4.3.1.2 Rig Inspection

- 1) The operator and contractor shall perform a weekly detailed rig inspection. An inspection check sheet shall be used and retained.
- 2) A complete inspection and blowout prevention drill will be conducted:
 - Prior to drilling out the surface casing;
 - Prior to drilling out the intermediate casing, and
 - Within the 24 hour period prior to penetrating the critical zone.

The Commission field office must be notified at least 48 hours prior to these inspections and drills being initiated, so that staff may witness these activities if judged appropriate.

11.2.4.3.1.3 Kick Detection

- 1) Each rig shall have installed and operate an automated mud tank volume monitoring system that meets the following specifications:
 - The system will be designed and installed so that it is capable of detecting a gain or loss of 1.0 m³ in total drilling fluid volume;
 - A fluid volume monitoring station with an alarm must be located at or near the driller's position and be visible. The monitor must be equipped with a recording chart;
 - The monitoring station must have a large bright flashing indicator light which will come on automatically whenever the alarm is shut off;
 - When drilling, the alarm must be set to detect a gain or loss in total drilling fluid volume of not more than 2.0 m³.
- 2) Each driller must have an adequate understanding of the proper operation of all kick detection and monitoring equipment.
- 3) Indicators must be in operation for measuring the hook load, pump pressure, the pump strokes-per-minute, and table torque. All such indicators must be visible from the driller's position.
- 4) A continuous recording device is required to record rate of penetration, pump pressure, pump strokes-per-minute, hook load, rotary table rpm, and rotary torque. This record must be kept for the entire well and be made available for inspection at the well-site until rig release.
- 5) A trip tank is required which must meet the following criteria:

- The trip tank design must be such that a change in level of 25 mm equals a volume change of not more than 0.075 m³. This equates to a maximum surface area of 3.0 m². A minimum useable trip tank volume of 3.0 m³ is recommended;
 - The hole fill volume must be measured either by manual gauging of the trip tank or by reading a mechanical or automated system visible at the driller's position. If a mechanical monitoring system is in use, the volume increments on the monitoring board must be 0.1 m³. If an electronic probe is used, the monitor's measurement increments must not exceed 0.0375 m³ and the monitor must have a readout to two (2) decimal places;
 - The hole must be filled to surface after every 15 singles (maximum) of drill pipe and after every three singles (maximum) of drill collars, are pulled;
 - A trip record is required for every trip, and it shall be signed and dated by the operator's well-site supervisor and the contractor's rig manager. All trip records for the well must be kept and made available for inspection at the well-site until rig release; and
 - Each trip record must show the actual volume used each time the hole is filled as specified above. The cumulative total fill volume must also be recorded after each successive fill. On the same page the record must also show the theoretical value required at each fill point, plus the theoretical cumulative fill volumes.
- 6) A minimum five minute flow check is required prior to beginning a trip out of the hole, after pulling the first singles of drill pipe from the hole, prior to pulling the first stand of drill collars from the hole, and after all the drill string is out of the hole.

11.2.4.3.1.4 Monitoring for H₂S Contamination of the Drilling Fluid

If a water-based drilling fluid is in use, a check and record of the sulphide content in the mud must be maintained throughout the critical period. In addition a continuous pH monitoring system must be located as close as possible to the flowline discharge of the drilling rig. The monitoring unit is to be equipped with an alarm that will indicate a drop in pH.

11.2.4.3.1.5 Ambient H₂S Detection

- 1) Each drilling rig must have a continuous H₂S detection monitoring device that activates audible and visual alarms near the driller's position when sensing an ambient air H₂S concentrations of 10 ppm or greater. The system must consist of at least one sensor located at the shale shaker which can detect H₂S concentrations of 5 ppm and greater. Additional sensors may be placed at other locations such as the bell nipple, rig floor, and mud mixing unit. Sensors must be able to detect H₂S concentrations of 5 ppm and greater. Qualified personnel should be on site to function test and provide maintenance to this instrumentation.
- 2) At least one working portable ambient H₂S concentration detection device shall be on location.

11.2.4.3.1.6 Drill Pipe

Operators must evaluate the metallurgy of the drill pipe proposed for special sour wells using the following criteria:

- Will drill stem testing be done;
- Will there be a possibility of a sour gas kick with subsequent exposure of the drill pipe to sour gas.

For each case the operator must justify the use of the proposed drill string on a site-specific basis.

11.2.4.3.1.7 BOP Manifold

The BOP manifold configuration shall conform to IRP 1 – Critical Sour Drilling.

- 1) The manifold and piping will provide complete redundancy from the BOP stack, through the manifold, to the degassers, and finally to the flare pit;
- 2) Where only one degasser has been approved, redundancy from the manifold to the single degasser, and from the degasser to the flare pit is not required;
- 3) A separate bleed-off line from each spool to a separate manifold wing (side) is required. A separate casing pressure gauge for each manifold wing is required;
- 4) A remote hydraulic operated non-rubber sleeve choke is required on the primary manifold wing (upper BOP spool) and a manual operated choke is required on the secondary manifold wing (lower BOP spool);
- 5) BOP manifolds shall be filled with suitable water soluble non-freezing fluids and adequately heated during the winter season.

11.2.4.3.1.8 Mud-Gas Separators (Degassers)

- 1) Two mud-gas separation devices are required for the drilling of special wells.
- 2) Notwithstanding (1), upon application the OGC may approve the use of a single mud gas separation device for the drilling of special wells providing:
 - The maximum potential H₂S release rate (section 11.2.3.2) has been estimated at less than 2.0 m³/s;
 - The geologic prognosis of the proposed well is well established on the basis of offset wells;
 - Normal formation pressures are expected (i.e. less than or equal to fresh water gradient);
 - No significant lost circulation is expected; and
 - The consequences of a blowout are considered minimal.
- 3) The primary device, must be an atmospheric, open bottom, mud-gas separator and conform to the specifications contained in IRP 1 – Critical Sour Drilling. The secondary device may be an enclosed mud-gas separator.
- 4) Degasser vent lines shall be sloped down towards the flare pit.

11.2.4.3.1.9 Drill String Valves

- 1) Lower kelly cocks and stabbing valves must be certified by the manufacturer as being able to be routinely opened with 7000 kPa pressure below the valve;
- 2) Lower kelly cocks must be installed.

11.2.4.3.1.10 Intermediate Casing

- 1) Intermediate casing shall be set to an appropriate point above the zone from which the sour gas or oil is expected.
- 2) Notwithstanding (1) upon application the OGC may waive the requirements for intermediate casing providing:
 - The geologic prognosis of the proposed well is well established and it offsets existing development;
 - No significant lost circulation is expected;

- No abnormal formation pressures (greater than fresh water gradient) are expected; and
- The wellbore (surface casing and open hole section) integrity will be evaluated prior to penetrating the critical zone and found satisfactory,

11.2.4.3.1.11 Personnel

- 1) Supervision:
 - On-site supervisors must have a current PITS Second Line Supervisor BOP Well Control certificate, H₂S awareness training, and experience in drilling sour wells;
 - During the critical portion of the drilling operation, sufficient supervision must be on-site and available so that no individual supervisor is required to work a shift longer than 12 hours.
- 2) Rig Crew:
 - On-site rig managers must have a current PITS Second Line Supervisor BOP Well Control certificate, and drillers must have a current PITS First Line Supervisor BOP Well Control certificate;
 - On-site rig managers and drillers must have H₂S awareness training, and experience in drilling sour wells;
 - A minimum five man drilling crew shall be maintained and all crewmembers shall be trained in H₂S safety.
- 3) Key Service Personnel:
 - Key service personnel including mud-men, loggers, geologists, etc., shall have previous experience in sour well drilling operations; and,
 - All well-site personnel shall be trained in H₂S safety.
- 4) Safety Specialists and Equipment:
 - During the critical portion of the drilling operation safety personnel and adequate safety equipment for all workers must be on-site.

11.2.4.3.1.12 Surveys

The drilling plan must provide for the taking of a directional survey prior to penetrating the critical zone, unless the applicant can satisfy the OGC that it is not needed. [Section 51 of the Drilling and Production Regulation](#) indicates the minimum requirements for surveys.

11.3 Definitions

Completion/Service Stage: includes all operations that are continuously attended subsequent to the drilling stage and, which are necessary to prepare the well to produce, or after a period of production, to restore the well or to repair the well.

Critical Time and/or Depth: any time or depth starting with some reasonable period prior to when a well has penetrated or may have penetrated any formation (or combination) that may be capable of flowing H₂S at critical sour well rates, and continues until such formations have been rendered incapable of flowing into the wellbore by running and cementing casing, or by cement abandonment plug, or approval has been given by the OGC to reclassify the well or formation as not critical.

Drilling Stage: includes all operations that are continuously attended, from spudding-in until production casing is cemented or the well is abandoned.

Emergency Planning Zone (EPZ): an area surrounding a well where residents or other members of the public would be at risk in the event of an uncontrolled release of H₂S. Its size is generally determined using Figures 11-1 as guidelines.

Flow Configuration: the well equipment and flow configurations to be considered in determining H₂S release rate at various stages of a well's drilling or producing life. These are:

- Casing flow or open hole flow where reservoir fluids are free to flow up the casing or open hole without any other tubular goods in the wellbore;
- Tubing and annular flow where reservoir fluids flow up the tubing and the annular space between the tubular string and the casing or open hole; and,
- Tubing flow where flow is only up the tubing.

H₂S evacuation level: when downwind monitoring at the nearest unevacuated downwind residence, outside the emergency planning zone, indicates a level of 10 ppm, evacuation procedures will be initiated if safe to do so.

Level Classification: a designation to stipulate separation distances of sour wells for land-use, and safety purposes. The level classification for sour wells is determined by assessing the maximum potential surface H₂S deliverability that can be attained against zero back pressure during the producing stage of a well. A well may be completed with a packer and flowing through tubing only, or completed without a packer and flowing through tubing and also up the annulus. The appropriate flow configuration must be considered in arriving at the level classification.

Potential H₂S Release Rate: the calculated H₂S deliverability that can be attained at surface against zero back pressure with various flow configurations, expressed using the unit of m³/s at standard pressure and temperature conditions.

Public Facility: a recreational area such as a campground or a public building such as a rural school or hospital, situated outside of an urban centre; and includes any similar development the OGC may designate as a public facility.

Separation Distance: the required distance between a sour well and developments such, as individual permanent dwellings, unrestricted country development, public facilities, and urban centres.

SO₂ evacuation levels – 5 ppm for a 15 minute period (mandatory), the SO₂ ambient concentrations at which evacuation must be initiated are as follows:

- 1.0 ppm for 3 hours (voluntary);
- 0.3 ppm for 24 hours (voluntary).

Sour Gas: natural gas, including solution gas, containing hydrogen sulphide (H₂S).

Sour Facility: any facility that handles sour gas containing greater than 0.01 per cent (100ppm) hydrogen sulphide (includes gas wells or oil wells producing or capable of producing sour gas.)

Sour Well: any oil or gas well expected to encounter sour gas bearing formations during drilling or any oil or gas well capable of producing sour gas.

Special Sour Well: a designation that reflects the proposed well's proximity to populated centres and its maximum potential H₂S release rate during the drilling state (see section 11.2.4.1). The casing or open-hole flow configuration is assumed in arriving at this designation.

Surface Improvement: means a railway, pipeline or other right-of-way road allowance, surveyed roadway, dwelling, industrial plant, aircraft runway or taxiway, building used for military purposes, permanent farm buildings, school or church.

Suspended/Producing Stage: includes all operations, which are not continuously attended, at wells that may or may not be capable of producing.

Uncontrolled flow unrestricted flow at surface that cannot be shut off at the operator's discretion.

Unrestricted Country Development: any collection of permanent dwellings situated outside of an urban centre and having more than eight permanent dwellings per quarter section; and includes any similar development the OGC may designate as an unrestricted country development.

Urban Centre: a city, town, village or other incorporated district with not less than 50 dwellings, any First Nation reserve and includes any similar development the OGC may designate as an urban centre.

Index

A		M	
Air Monitoring	14	Municiple Emergency Plans.....	12
B		O	
BOP Drills	25	Off-Site Control Centre	14
C		On-Site Command Post	14
Casing bowls		P	
threaded.....	25	Public facility	29
welded.....	25	R	
Closure order	6	Reception Centre	14
Communications	14	Reciprocal setbacks.....	22
Corporate Plan		Release rate determination	2
definition of	2	Residents' Package.....	16
requirements for.....	18	Roadblock equipment.....	13
D		Roadblocks.....	13
Dual ignition system.....	21	S	
E		Sheltering Criteria	12
Emergency awareness zone	17	Sheltering Procedures.....	12
Emergency planning zone		Site-Specific Emergency Response Plan	
calculation of	2	definition of.....	4
reduced.....	21	Sour gas	30
Emergency Response Plans		Special Plan	
distribution of.....	8	definition of.....	4
Evacuation Criteria	9	Special sour wells	
Evacuation Procedures.....	9	classification criteria	23
I		Surface improvement	30
Ignition		U	
authority for	13	Uncontrolled flow	30
Ignition Criteria	13	Unrestricted country development.....	30
Ignition Procedures.....	13	Urban Centre	30

Appendix-1- CHARACTERISTICS AND DANGERS OF H₂S

- Found in decaying organic matter, natural oil and gas, silos, sewers
- Found as a gas at temperatures above -60°C
- Colourless
- Flammable - burns to form SO₂
- Odour of rotten eggs at low concentrations - kills all sense of smell at higher concentrations
- Will tend to disperse more slowly in sheltered or calm or low lying areas
- Extremely toxic
- At lower concentrations (20-50 ppm) irritates mucous membranes (eyes, throat, lungs), causes headache, dizziness, nausea, may cause pulmonary edema (fluid in the lungs) upon prolonged exposure
- High concentrations (500-1000 ppm) causes paralysis of the respiratory centre in the brain - breathing stops, suffocation occurs
- This gas is dangerous because it kills the sense of smell very quickly and one is not aware of the level of concentration that is present.

GENERAL HEALTH EFFECTS OF H₂S

Concentration (ppm)	Effects
0.01-0.3	Odour threshold
1-5	Moderate to strong offensive odour may create nausea, tearing of the eyes, headaches or loss of sleep upon prolonged exposure-effects are moderate
10	Ceiling Limit (B.C. WCB)
20-50	Slight eye and lung irritation-may cause eye damage after several days of exposure; may cause digestive upset and loss of appetite
100	Eye and lung irritation
150	Kills sense of smell; severe eye and lung irritation
500	Serious damage to eyes within 30 minutes; severe lung irritation; unconsciousness and death within 4 to 8 hours
1000	Breathing stops within one or two breaths

Adapted from:

Canada Safety Council Data Sheet "Hydrogen Sulphide," No. B-3.

Alberta Provincial Board of Health "Guidelines for Action Regarding Hydrogen Sulphide."

National Research Council of Canada, "Hydrogen Sulfide in the Atmospheric Environment: Scientific Criteria for Addressing its Effects on Environmental Quality," publication #18467.

Appendix 2 - CHARACTERISTICS AND HEALTH AFFECTS OF SO₂

This is a choking gas, unlike H₂S, and one wants to move to an area where the discomfort is not experienced.

- Formed by the combustion of H₂S or sulphur and is non-flammable;
- Found as a gas at temperatures above -10°C;
- Has the odour that occurs when a wooden match is extinguished;
- Highly irritating - dissolves to form sulphuric acid;
- At lower concentrations irritates the eyes, nose and throat, causes difficulty in breathing and shortness of breath;
- Causes pulmonary edema at high concentrations - may be fatal; and
- Effects on heavy smokers are more severe.

GENERAL HEALTH EFFECTS OF SO₂ *

Concentration (ppm)	Effects
0.13	24 hour evacuation level (MWLAP Level B criteria)
0.34	One hour average evacuation level (MWLAP Level B criteria)
2	Eight hour Occupational Exposure Limit (BC WCB)
3-5	Odour Threshold
5	15 minute Occupational Exposure Limit (BC WCB)
8-12	Throat irritation, coughing, constriction in chest, tearing and smarting of the eyes
10-50	Exposure 5-15 minutes: increased irritation of the eyes, nose, throat, choking, coughing, and in some cases, wheezing as a sign of narrowing of the airways (which increases the resistance of the air-flow)
150	Short-term endurance lost due to severe eye irritation and because of the effects on the membranes of the nose, throat and lungs
500	Highly dangerous after an exposure of 30-60 minutes
1000-2000	May be fatal with continued exposure

* Adapted from Canada Safety Council Data Sheet "Sulphur Dioxide," No. B-4.