Appendix 2
Background Information

The background information which follows is intended for those not familiar with North Slope facilities and is provided as an aid in understanding the Investigation Report. Photographs and a diagram of a typical well have been provided to aid in understanding the written discussions but it is important to realize that the photographs and diagram are only representative and that there are many styles of wells, well cellars, well houses, and well pads.

There are approximately 2100 wells operated by BP on the North Slope. Some are used for functions other than extracting crude oil directly from the ground, or more accurately extracting a mixture of gas, water, crude oil, and other constituents present in deep lying formations, some of which are several miles below the surface. Examples of other well functions include: returning extracted gas and water back into underground areas to aid in further crude oil extraction; returning the material that was displaced when a well is drilled back into the ground; and extracting water from the ground, using it for cooling equipment and operating pumps and then re-injecting it at a location that will aid in greater crude recovery.

Regardless of a wells function, most wells and specifically those that are the subject of the allegations under investigation, have common characteristics which include:

1. All wells have barriers to prevent crude oil and gas located in deep formations from reaching the surface in any manner other than through the center tube of the well which is called the production tubing. If formation oil and/or gas were to reach the surface in an uncontrolled way, even in limited quantities, it would be a dangerous situation which could result in fire, explosion, and serious injury or death. Figure 1 is a diagram of a typical well.

2. The vast majority of wells are intentionally freeze protected with diesel oil, arctic pack (diesel oil mixed with bentonite), "dead" crude (crude oil which has weathered such that all volatile constituents have been removed), or a combination of these substances. Freeze protection is required to protect the well from damage that could occur from freeze thaw cycles if it were not present. The freeze protection fluid is introduced in to the outer annulus of the well to a depth of about 2000 feet. Beyond that depth, freeze protection is not required because temperatures remain above freezing.

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During its lifetime, a well will undergo numerous shut in and restart sequences that result in thermal cycles that can exceed 80 degrees Fahrenheit. The heat from these thermal cycles radiates into the outer annulus of the well (where the freeze protection fluid is located) which raises the temperature in the outer annulus thus increasing annulus pressure and expanding the freeze protection fluid volume. A surface casing leak is the probable pathway for fluids to move from the outer annulus to the annulus space between surface casing and conductor casing, which is open by design to the well cellar in many North Slope wells.

3. The pressures in a well's production tubing and the annular spaces between casings are monitored to detect situations in which there may be leakage (called communication) through a well casing. If leakage is detected, and the well still has sufficient safety margin to prevent formation fluids from reaching the surface, continued operation may be allowed if analysis determines it is safe and prudent.

4. There is a tower like assembly of valves visible above the ground (actually a gravel pad) which provides surface control for produced fluids, and a connection point for the flow line to carry fluids to processing centers. The assembly is referred to as a production tree. Photo 1 is a picture of a production tree that is no longer in service and without a well house enclosure. The water in the background is a reserve pit which was dug originally to contain the material that was displaced when the wells were drilled.

5. Wells are enclosed in well houses which can be removed for maintenance. Photo 2 shows a well house and photo 3 shows a row of well houses on a gravel well pad. Photo 3 also shows a tundra pond and tundra adjacent to the well pad.

6. Most wells have an associated "cellar" which is actually formed by excavating the gravel from immediately around the well casings and tree. Cellars typically extend 4 feet outward and extend downward approximately 6 feet. Some cellars are cylindrical in shape and others are cubic. Dimensions of the cylinders and cubes making up the cellars vary as do their contents and construction material.

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Retaining walls are used to keep the cellars from refilling with gravel. In some cases cellars also have a floor other than the pad gravel. Walls and floors are built with various materials including steel, cement, wood, and corrugated metal.

Cellars that are not completely or nearly completely filled with gravel have a metal grating installed to prevent personnel and equipment from falling into the cellar; others provide this protection by means of boards placed over the cellar opening.

Photo 4 is a picture of a well cellar. There are other cellar photos in the findings section of this report and in appendix 5.

7. Cellars tend to accumulate significant amounts of water from rain and snow melt during spring break up. The exact way a well cellar can fill with water during break up is a function of many variables including: cellar construction, cellar top height relative to the well house gravel floor, the depth of the cellar, whether the cellar has a floor other than gravel, whether the cellar has a liner (or other secondary containment) and its effectiveness in retaining fluid, and the elevation of the well house gravel floor relative to the well pad elevation.

8. Wells and associated well houses and cellars are located on pads which consist of gravel that has been brought to the well site and graded. The top of the pad varies from about 5 to 10 feet above the tundra. Typically one side of the pad is bounded by a reserve pit (generally referred to as the pit) which was initially used to contain drilling mud and now serves as a catch basin for rain water and snow melt. The other side of the pad typically borders on tundra and associated tundra ponds. Wells are typically sited on the pad closer to the pit than to the tundra. There are instances however where wells are closer to the tundra than the pit. Pits tend to collect water and are periodically pumped down.

   In general, the water level of the pit is higher than the water level in adjacent tundra ponds. As a result, when the pit water level is higher, there is an underground flow of pit water through the well pad gravel to the tundra.

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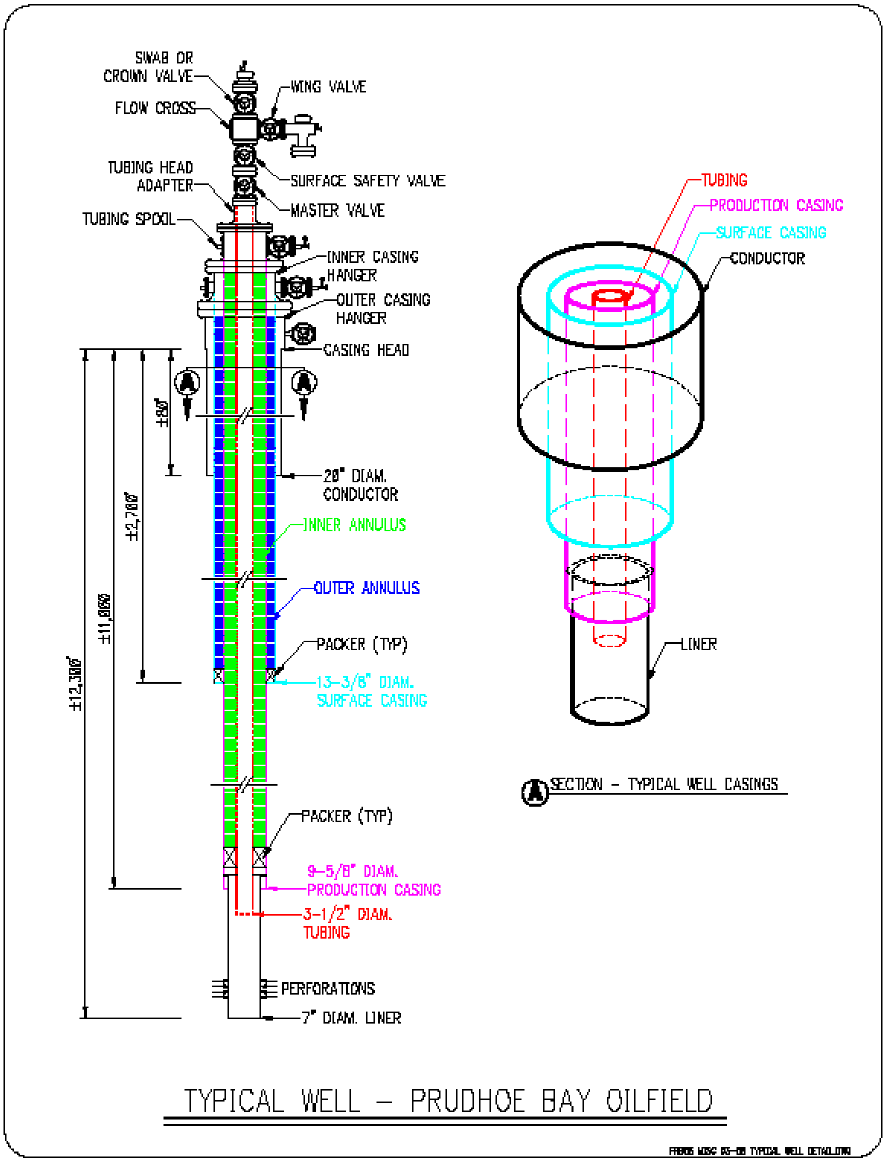

Figure 1

Background Information

Photo 1: Well tree from a disconnected well with well house removed – Water area in background is a Reserve Pit – The gravel area from which the tree emerges is the pad.

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Photo 2: A typical well house on a well pad with a reserve pit in the background

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Photo 3: A row of well houses on a well pad with a tundra pond in the foreground

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Photo 4: Picture of a well cellar with herculite secondary containment