APPENDIX I

Supervisory Control and Data Acquisition System Operation and Backup

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For purposes here, Supervisory Control and Data Acquisition (SCADA) system refers to a set of equipment that makes possible remote monitoring and control of facilities. A SCADA system is normally composed of measuring instrumentation (for flow, pressure, temperature, density, etc); control equipment (valves, engine controls, etc); transmitters; Remote Terminal Units (RTUs); communication pathways (telephone, satellite, microwave, etc.); and a central computer system. Control logic exists either in local equipment [programmable logic controllers (PLC)] or in the central computer system.

As an element in risk management, a SCADA system impacts risk in several ways:

- Human error avoidance;
- Leak detection;
- Emergency response; and
- Operational efficiencies.

The Longhorn pipeline will be operated from the WES NGL Operations Control Center. The Center consists of five consoles, four of which are used to operate the various pipelines. A fifth console is used for training, for system development, and as a backup to the four operating consoles. Each console consists of four displays. Three of the displays are dedicated to line-specific information, and the fourth display acts as a dedicated alarm page. Information is displayed in a tabular format with graphical screens available on request. Each of the four console positions operates a specific section of the pipeline system, although any information can be displayed on any display upon command.

The NGL Operations Control Group consists of 18 Pipeline Controllers. There are 16 controllers in rotation with 2 in relief positions. The controllers work 12-hour shifts that provide coverage 24 hours a day for all 365 days in a year. The four controller consoles are divided into two groups of two consoles each. Eight controllers per group rotate through each of the two-console groups, and one relief controller is assigned to each group.

The SCADA system uses a “modified” modbus RBE protocol. The RTUs will send in unsolicited data using a specified time sequence. This is currently set at 5 seconds. The data will be sent from the RTUs to the SCADA System if the data change outside a preset deadband (currently set at 0.5 percent). The NGL SCADA System also uses a “health” check poll that is currently set at 2 minutes for each RTU. The “health” check poll retrieves all of the data from the RTU and verifies its functionality.

The commands that are sent from the SCADA System to the field locations are handled with priority. When a command is issued, it is processed and immediately sent to the RTU. If the command is not processed properly, the SCADA System generates an alarm that states that the command could not be verified.

The SCADA and communication backup systems utilize hot and standby systems for total redundancy. The system incorporates several communications paths for added robustness. The paths consist of VSATs, Lan/Wan connections, radios, and lease lines. The system also includes an automated dial backup system in case the primary communications link is lost. Each pumping station on the Longhorn pipeline will have a camera system that will allow viewing of the area if any abnormal situation arises.

As with any system, the SCADA system is only as effective and reliable as its weakest component. A thorough assessment of a SCADA system would ideally involve an examination of the entire loop, from first indication of an abnormal condition, all the way to the final actions and associated system response. This assessment would therefore involve an evaluation of the following aspects:

- Detection of abnormal conditions: An assessment of the types of events that can be detected. For example, an estimation of the detection sensitivity and reliability in terms of 100 percent of event type A's will be found; 76 percent of event type B's will be found; etc. This includes assessment of redundant detection opportunities (by pressure loss AND flow increase, for instance), instrument calibration and sensitivities, etc.

- Speed, error rate, and outage rate of the communications pathways; number of points of failure; weather sensitivity; third-party services; average refresh time for data; amount of error-checking during transmission; "report-by-exception" protocols;

- Redundancy in communication pathways; outage time until backup system in engaged;

- Overall reliability (outage rate) considering all points of failure, system redundancy, overload potential, software error rates, time to bring redundant systems on-line, etc.

- Type and adequacy of automatic logic control; local PLCs vs. central computer; ability to handle complex input scenarios;

- Human response, if required, as a function of time to recognize problem, ability to set alarms limits, effectiveness of Man-Machine-Interface (MMI); operator training; support from logic, graphic, and tabular tools; and

- Adequacy of remote and/or automatic control actions; valve closing or opening; pump shut-down, instrument power supply, sequencing of actions to prevent undesired consequences, etc.

If the Longhorn SCADA system becomes temporarily unavailable, key locations in the field are notified so they can monitor the pipelines locally. Currently, Operations & Maintenance manuals state that if the outage extends for 2 hours, or at the discretion of the controller, field technicians are dispatched to all operating pumping stations to man the facility. Abnormal conditions are called in to the controller, and routine pressure and flow information is relayed at regular intervals. If the outage extends for more than 2 hours on a refined products pipeline, the local technicians are instructed by the controller to shut down the pipeline. These time limits are

adjusted, if necessary, wherever the SCADA system is a required element of any leak detection capability.

Excluding the outages due to Y2K testing and maintenance, the SCADA System had an availability of 99.954 percent in 1999. A more extensive SCADA evaluation has not been performed for the Longhorn pipeline at this time. As a critical component of Longhorn's leak detection commitment, the SCADA reliability must be consistent with the leak detection capabilities that are specified in the Longhorn Mitigation Plan. These capabilities are required under all flow conditions. As part of the final review and approval of the systems to be used, component failure rates, redundancies, and overall system "up time" must be considered in order to achieve the required capabilities. DOT will ensure that commitments are met.