CITY OF [redacted] OHIO
[redacted] WATER TREATMENT PLANT
PROCESS HAZARD WHAT IF ANALYSIS

Date: December 7, 2005			
WHAT IF...	CAUSES	POSSIBLE RELEASE SCENARIO	SAFEGUARDS
A chlorine cylinder is dropped during transport to the Chlorine Building?	Hoist cable breakage.	Minimal if any, the cylinder should not rupture if dropped.	Hoist inspected annually, cable replaced annually.
A chlorine cylinder is dropped from the hoist during cylinder changes?	Hoist cable breakage.	Minimal if any, the cylinder should not rupture if dropped.	Hoist inspected annually, cable replaced annually.
A chlorine main cylinder valve develops a leak while the cylinder is in operation?	Gasket leak, packing nut leak. bad threads on valve or connecting nut.	Possible 0.44 lbs/minute for 60 minutes – 17.1 lbs total release.	Use of a gas detector and alarm, packing nut inspected each hook up, effective written procedures for cylinder changes and operation.
A chlorine leak develops while testing the main valve connection during cylinder hookup?	Gasket leak, packing nut leak, bad threads on valve or connecting nut.	Possible 0.44 lbs/minute for 60 minutes – 17.1 lbs total release.	Use of a gas detector and alarm, packing nut inspected each hook up, effective written procedures for cylinder changes and operation.
The pigtail tubing connecting a cylinder to the chlorine gas piping develops a leak?	Excessive wear.	Possible 10.5 lbs/minute for 60 minutes – 317 lbs total release.	Effective training program, use of gas detector, effective preventive maintenance program, tubing replaced annually.
The pigtail tubing is connected to the lower main cylinder valve (liquid) rather than the upper main cylinder valve (gas)?	Cannot happen due to drip leg hitting cylinder		
The lower main cylinder valve (liquid) develops a leak while the cylinder is in service?	Malfunction of the valve, packing nut leak.	Possible 10.5 lbs/minute for 60 minutes – 317 lbs total release.	Use of gas detector, written cylinder changing procedures, supplier cylinder inspections.
The gas header or manifold develops a chlorine leak while it is pressurized?	Normal wear or corrosion.	Possible 46.8 lbs/minute for 27 minutes – 1,268 lbs total release, though not likely as loss of vacuum shuts off the regulator.	Use of gas detector, inspection of manifold, could use secondary manifold hook up.
The pressure reducing valve vent becomes stuck in the open position?	N/A		

DRAFT

DRAFT

CITY OF [illegible] OHIO
[illegible]ATER TREATMENT PLANT
PROCESS HAZARD WHAT IF ANALYSIS

Date: December 7, 2005			
WHAT IF...	CAUSES	POSSIBLE RELEASE SCENARIO	SAFEGUARDS
The chlorine gas pressure exceeds the normal working gas pressure?	N/A		
The pigtail tubing is disconnected from a cylinder before the cylinder and gas piping are evacuated of chlorine gas?	Lack of training.	Minimal if any.	Short pipe runs, use of SCBA during cylinder changes, effective training program.
A chlorine gas leak develops at the connection to the vacuum regulator?	Corrosion or deterioration of the piping.	Possible 46.8 lbs/minute for 27 minutes – 1,268 lbs total release.	Tighten yoke and/or replace lead washer.
A chlorine leak develops in vent line inside the Chlorine Building?	Brittle or deteriorated tubing.	Minimal if any.	Effective preventive maintenance program and inspections.
A fusible plug opens on a cylinder releasing chlorine gas from the cylinder?	Excessive heat, fusible plug thread leak.	Possible 46.8 lbs/minute for 27 minutes – 1,268 lbs total release.	Temperature controlled room, use of leak repair kit.
Empty chlorine cylinders are repressurized during cylinder change operations before they are disconnected?	Vacuum regulator failure.	None.	Replace or repair vacuum regulator.
A chlorine leak develops in one of the chlorinator components (e.g. pressure relief valve, rotameter, differential regulating valve, etc.) while it is operating	Deterioration of the components.	Possible 10.5 lbs/minute for 60 minutes – 317 lbs total release.	Effective written operating procedures, effective preventive maintenance program, use of the gas detector.
A chlorine solution leak develops in a chlorine solution line in the Chlorine Building?	Deterioration of the piping.	Possible gassing off of some chlorine from solution.	Leak enclosed in the building, effective preventive maintenance program..
A chlorine solution leak develops in a chlorine solution line outside the Chlorine Building or at a feed point location?	Deterioration of the piping.	Possible gassing off of some chlorine from solution.	Effective preventive maintenance program.

DRAFT

OHIO
WATER TREATMENT PLANT
PROCESS HAZARD WHAT IF ANALYSIS

Date: December 7, 2005			
WHAT IF...	CAUSES	POSSIBLE RELEASE SCENARIO	SAFEGUARDS
A chlorine gas line or connection is broken during work being performed on the system?	Lack of training.	Possible 10.5 lbs/minute for 60 minutes – 317 lbs total release, though not likely due to loss of vacuum closing regulator.	Effective preventive maintenance program.
A chlorine solution line or connection is broken during work being performed on the system?	Lack of training.	None.	Effective training program.
The chlorine gas sensor fails to signal a leak to the gas detector?	Malfunction of sensor, electrolyte in sensor contaminated.	None.	Sensor is tested periodically, sensor is replaced based on the manufacturer's recommendations.
The gas detector fails to indicate a chlorine leak in the Chlorine Building?	Malfunction of the controls or components.	Depends on location of leak.	None at this time. Need to implement a detector testing program per the manufacturer's recommendations.
The exhaust fan is operating when a chlorine leak occurs?	Lack of training, operator error.	Depends on the location of the leak.	Effective training program and written procedures.
The air intake louver is open when a chlorine leak occurs?	Malfunction of the louver.	Minimal if any.	Effective preventive maintenance program, effective training program.
A chlorine leak occurs during normal operating status checks?	Gasket leak, packing nut leak, deterioration of the piping.	Depends on the location of the leak.	Effective preventive maintenance program, effective training program.