October 25, 1973

UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY, et al.	)	Docket No. 50-289
	)	
(Three Mile Island Nuclear Station, Unit 1)	)	

APPLICANTS' PREPARED TESTIMONY RELATED TO CHLORINATION

Introduction

Chlorine is a toxic gas which consists of two atoms of chloride. It is used in most drinking water supplies for disinfection to kill disease-producing organisms. When chlorine mixes with water it produces hypochlorous acid (HOCl) and hydrochloric acid (HCl). The destruction of organisms results from a chemical reaction of HOCl with an enzyme in the cell.

Most waters have a chlorine demand in the sense that biological materials are present which consume the chlorine. Chlorine demand is thus defined as the difference between the amount of chlorine applied to a water and the residual chlorine remaining at the end of a specified contact period.

Chlorine demand is established by laboratory test.

Chlorine residual is that amount of chlorine that remains after a selected reaction period and is measured in ppm. Free available chlorine residual is the chlorine remaining after it has combined with ammonia and ammonia compounds. Chlorine residual can be measured by the orthotolidine test which is accurate to about ±37% at concentrations below 0.6 ppm. This is a manual on-the-spot test of the type performed at swimming pools. It can also be measured by a continuous amperometric test. This consists of an analyzer which conditions the sample and measures, by means of electrodes, the current which varies with chlorine. Accuracy of the amperometric test is ±25%.

Chlorine is used and has been used for many years for algae and slime growth because it has been found to be superior in penetrating the enzyme cell walls as compared to other disinfectants. The philosophy of its use in power plants through the years has been to use enough chlorine to prevent excess growths in the circulating water system but limit the residual to values below 0.5 ppm at the outlet of the condenser.

Chlorination at Three Mile Island

Three Mile Island Unit 1 (TMI 1) has a closed cooling system utilizing natural draft cooling towers. Chlorination will be employed for control of algae and slime growth in these cooling towers, the associated condensers, and the

remainder of the closed cooling system. When chlorine is intermittently fed to a residual of 0.5 to 1.0 ppm within the closed system, some chlorine is released with blowdown water from the system. The blowdown water mixes with the cooling water in a second smaller cooling system--the open system described below--before discharge to the River. It is expected that the chlorine residual in the blowdown water will rapidly decrease to zero since the ratio of blowdown water flow to cooling water flow in the open system will be about 1 to 8 and the chlorine demand of the open system cooling water will readily use up the residual in the blowdown water.

Each unit at Three Mile Island also has an open cooling system for the nuclear services and secondary services heat exchangers. Chlorine will also be fed intermittently into this system to minimize the growth of algae and slime in its heat exchangers so that they can be operated efficiently and continuously without shutting down. Shutting down for manual cleaning is undesirable and costly. Chlorination will be scheduled so that feed to the closed cooling system and to the open cooling system are not simultaneous.

Historically, intermittent shock treatment with chlorine residuals in the range of 0.5 to 1.0 ppm have been found to be effective in cooling water systems to control

algae and slime growth. Recently EPA has recommended a limit of 0.2 ppm for chlorine residuals. It is felt that a total chlorine residual of 0.2 ppm at the River discharge of the open cooling system at Three Mile Island may not be adequate for effective algae and slime control in the open cooling system. Adequacy of treatment can only be determined with operating experience during the worst growth period.

The proposed TMI Technical Specification related to chlorine states that total chlorine concentration as measured at the River water discharge shall not exceed 0.2 ppm and the free chlorine component shall be less than 0.1 ppm, except for one period of ninety consecutive days to be selected by Applicant during the first year of plant operation. During this ninety day period, the 0.2 ppm limit may be exceeded up to a maximum concentration of 0.5 ppm. This exception to the 0.2 ppm limit is being included in the Technical Specifications to permit Applicant to determine, in the event it is found that operation with the 0.2 ppm limit is not sufficient to control algae growth, the minimum plant discharge concentration of chlorine which is sufficient.

A total chlorine residual analyzer-recorder of the amperometric type will be installed to continuously monitor a sample from the plant discharge to the River. An alarm will be provided to indicate when the Technical Specification limit is exceeded. Should an alarm occur, chlorination will be terminated immediately and the reason for excessive

chlorine will be determined and corrected.