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SITE-SPECIFIC ACCIDENT ANALYSIS FOR THE LATINA NUCLEAR POWER REACTOR IN BORGO SABOTINO, ITALY: ENVIRONMENTAL, MEDICAL AND ECONOMIC CONSEQUENCES

by

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I. EXECUTIVE SUMMARY

The management of the nuclear fuel cycle in Italy entails several hazards, the largest of which arises from the operation of nuclear power reactors. This paper presents a quantitative, site-specific analysis of an accident at the Latina reactor located in Borgo Sabotino, province of Latina, approximately 50 km south of Rome. Conventional quantitative methodology used by the U. S. Nuclear Regulatory Commission (NRC) to regulate the U. S. civilian nuclear industry is utilized to evaluate an accident at the Latina reactor (Appendix I). Although the present analysis is site-specific, it is to be emphasized that the consequences are typical of those following an accident at any nuclear reactor site in Italy.

An accident at the Latina reactor would release radionuclides to the atmosphere, in the form of a radioactive cloud. Assuming a typical prevailing wind from the south (Figure 1), the cloud would be carried northward from Rome in the form of a radioactive plume (Figure 2). Depending upon weather conditions, the radioactive plume could envelop all of Rome (Figure 2).

Using conservative assumptions (i. e., ones that understate the impact) and standard methodology, it is shown that downwind concentrations of select radionuclides would exceed U. S. federal limits by up to 300 times (Figure 5). Ground contamination would exceed U. S. limits by up to one million times (Figure 6). Radiation exposure from cloudshine would exceed U. S. limits for exposure of members of the general public by as much as 10,000 times, and by nearly 100 times in the city of Rome (Figure 8). Calculated inhalation exposure from all radionuclides exceeds U. S. limits by up to 30,000 times, and by nearly 100 times within Rome's city boundaries (Figure 10). Groundshine from all radionuclides for the one day period following the accident would exceed U. S. exposure standards by up to 5,000 times, and is above U. S. limits in the city of Rome (Figure 12). Summed short-term exposure from all radionuclides and all pathways would exceed U. S. standards by up to 50,000 times (Figure 13), and is well above the limit in Rome for all accident conditions modeled.

Casualties considered were limited to delayed fatalities from latent cancers. Depending on atmospheric conditions and the risk factor used, short-term casualties from all sources of exposure range from 37 (Figure 15A) to 7,220 (Figure 15B). In the worst case modeled, all persons within 20 km would die from short-term exposure. A large number of casualties, however, would also occur in the densely populated region south of Rome (11 - 3,223 fatalities) and in the southern part of the city itself (4 - 442 fatalities; Figure 15). Additional medium-term casualties from one week of subsequent groundshine under stable atmospheric conditions would range from 555 to 14,520 fatalities (Figure 16). Additional long-term casualties from one year of subsequent groundshine and stable atmospheric conditions range from 1,509 to 32,999 fatalities (Figure 17). Within the southern portion of Rome the calculated long-term casualties for the first year range from 50 to 2,166.

These results indicate that a reactor accident at Latina would force immediate evacuation of the affected downwind areas, and would require decontamination prior to rehabitation. It is questionable whether an emergency evacuation plan appropriate to this accident could be formulated or executed. Decontamination costs could reach tens of billions of U. S. dollars, and could easily exceed the capacity to pay, resulting either in unacceptable casualties or abandonment of the affected areas, including large portions of Rome.

The probability of such an accident is estimated to lie between 1.5 in one thousand and 1.5 in one hundred. Such probabilities are extraordinarily high for an accident with such profound environmental, medical and economic consequences.

The conclusions of this study raise the question of whether the small amount of electricity that would be generated by the Latina nuclear power station during its remaining operational lifetime justifies the substantial risk to such an irreplaceable national and international treasure as the city of Rome.