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Lessons from Fukushima for Improving the Safety of Nuclear Reactors

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The March 2011 accident at the Fukushima Daiichi nuclear power plant has revealed serious vulnerabilities in the design, operation and regulation of nuclear power plants. While some aspects of the accident were plant- and site-specific, others have implications that are broadly applicable to the current generation of nuclear plants in operation around the world. Although many of the details of the accident progression and public health consequences are still unclear, there are a number of lessons that can already be drawn. The accident demonstrated the need at nuclear plants for robust, highly reliable backup power sources capable of functioning for many days in the event of a complete loss of primary off-site and on-site electrical power. It highlighted the importance of detailed planning for severe accident management that realistically evaluates the capabilities of personnel to carry out mitigation operations under extremely hazardous conditions. It showed how emergency plans rooted in the assumption that only one reactor at a multi-unit site would be likely to experience a crisis fail miserably in the event of an accident affecting multiple reactor units simultaneously. It revealed that alternate water injection following a severe accident could be needed for weeks or months, generating large volumes of contaminated water that must be contained. And it reinforced the grim lesson of Chernobyl: that a nuclear reactor accident could lead to widespread radioactive contamination with profound implications for public health, the economy and the environment. While many nations have re-examined their policies regarding nuclear power safety in the months following the accident, it remains to be seen to what extent the world will take the lessons of Fukushima seriously and make meaningful changes in time to avert another, and potentially even worse, nuclear catastrophe.