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SUMMARY

NIF: Impacts of Chemical Accidents and Comparison of Chemical/Radiological Accident Approaches‡

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NIF: Impacts of Chemical Accidents and Comparison of Chemical/Radiological Accident Approaches[‡]

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The U. S. Department of Energy (DOE) proposes to construct and operate the National Ignition Facility (NIF). The goals of the NIF are to (1) achieve fusion ignition in the laboratory for the first time by using inertial confinement fusion (ICF) technology based on an advanced-design neodymium glass solid-state laser, and (2) conduct high-energy-density experiments in support of national security and civilian applications. Potential environmental impacts associated with the construction and operation of the NIF are being evaluated as a part of the assessments included in the Programmatic Environmental Impact Statement being prepared for the DOE Stockpile Stewardship and Management (SSM) Program. The environmental impact assessment for the NIF, within the SSM, includes consideration of impacts to air, water, land, visual resources; biotic, cultural and paleontological resources; noise and waste management; socioeconomics; and radiological and chemical health and safety. This paper provides results of postulated NIF accident predictions and addresses aspects of the NIF health-safety chemical and radiological accident assessments.

The primary focus of this paper is worker-public health and safety issues associated with postulated chemical accidents during the operation of NIF. The key findings from the accident analysis will be presented. Although NIF chemical accidents will be emphasized, the important differences between chemical and radiological accident analysis approaches and the metrics for reporting results will be highlighted. These difference are common EIS facility and transportation accident assessments.

The chemical accidents considered in the NIF assessment include (1) a mercury release from the ignitron switches, (2) a combined alumina/silica release from the target chamber, (3) a carbonyl fluoride release from the optics area, and (4) a hydrogen fluoride release from the optics treatment area. The health-related impacts of these releases are expressed with the following metrics:

- Safety distances based on the American Industrial Hygienists Association (AIHA) ERPG-2 value (allowing protective action and no irreversible health effects),
- Risk of fatality (potentially life-threatening health effects),
- Increased risk of cancer greater than 1 in 1 million, and
- Risk of any adverse health effect (other than cancer).

Radiological accidents considered for NIF are discussed in a companion paper (Hong, et al., 1996) in these transactions. The health related impacts for these accidents are expressed as latent cancer fatalities (within 30 years following exposure).

The chemical accident health impacts calculated for the preferred NIF alternative site at Lawrence Livermore Laboratory are compared with impacts calculated for four other locations at three other alternative sites. Results predicted using the RISKCHEM (also known as CASRAM[1]) code for safety distances indicate the maximum threat zone from the release point ranges from about 70 m for the carbonyl fluoride and hydrogen fluoride release scenarios to about 240 m for the mercury release. These impacts pose negligible or insignificant risk to public populations surrounding each of the sites considered. Impacts computed as safety distances implies no risk or consequences beyond that distance (depending upon accident), but the impacts expressed with the other metrics imply some finite risk.

To distinguish the differences associated with the expression of health impacts from accidental releases of radionuclides and chemical compounds, typical radiological impact measures (such as number of cancer fatalities and risk of cancer fatalities per year) are compared with the chemical impact measures described above. Radiological accident predictions using RISKIND[2] code are also be presented for comparison. Addition of measures are not possible because of the different meaning the metrics represent, even for those related to cancer. The "nearest residence" and "maximally exposed off-site individual" are used as special locations for impact predictions. Common and dissimilar aspects of the radiological and chemical impact modeling are listed and results are presented for the same postulated accidents.

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References

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2. Yuan, Y.C., etal., 1995: RISKIND - A computer Program for Calculating Radiological Consequences and Health Risks from Transportation Accidents, ANL/EAD-1, Nov.

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