APPENDIX C
FIRE HAZARDS ANALYSIS PROCEDURES

C1. The purpose of the fire hazards analysis (FHA) is to document specific fire hazards, fire protection features proposed to control those hazards, and the overall adequacy of facility fire safety. The FHA consists of a systematic analysis of the fire hazards, an identification of specific areas and systems important to facility fire safety, the development of design-basis fire scenarios, an evaluation of anticipated consequences, and a determination of the adequacy of facility fire safety.

C2. A preliminary FHA should be performed for the MOX facility early in the design phase to ensure incorporation of an acceptable level of protection in the evolving design.

C3. The FHA should be performed under the direction of a qualified fire protection engineer, with support from chemical, electrical, mechanical, and systems engineers, as well as operations staff as needed.

C4. The FHA should contain, but not be limited to, a conservative assessment of the following items and safety issues:

- Descriptions:
    - Construction (Type);
    - Fire hazards;
    - Fire protection features;
    - Critical process equipment; and
    - Operations.
- Potential for a toxic or radiation incident from a fire;
- Impact of natural hazards (earthquake, flood, or wind) on fire safety;
- Protection of items relied upon for safety;
- Life safety considerations;
- Emergency planning;
- Fire department/brigade response;
- Security and safeguards considerations related to fire protection; and
- Exposure fire potential and the potential for fire spread between two fire areas.

C5. The FHA should assume and evaluate the consequences of a single, worst-case automatic fire protection system malfunction during a fire. This could be a detection system that also functions to activate a pre-action type sprinkler system. The failures and/or events postulated in the analysis should be consistent with the probability criteria in the ISA.

C6. If redundant automatic fire protection systems are provided in the area, only the system that causes the most vulnerable condition is assumed to fail. Passive fire protection features, such as blank fire-rated walls or continuous fire-rated cable wraps are assumed

to remain viable in accordance with their fire endurance rating to the extent that they are properly constructed and maintained.

C7. The FHA is normally organized by the individual fire areas that comprise the facility. As defined in Section 7.7, a fire area is a location bounded by fire-rated construction, having a minimum fire resistance rating of 2 hours. The FHA through fire modeling (if necessary) and fire loading analysis should document that the fire ratings are appropriate for each fire area boundary. Where a facility is not subdivided by fire rated construction, the fire area should be defined by the exterior walls and roof of the facility.

C8. The FHA should contain an inventory of items relied on for safety that are susceptible to fire damage within each subarea. Loss of systems such as ventilation, cooling, or electrical power that could cause failures elsewhere in the facility should be evaluated. The FHA should also consider the improper operation of equipment due to spurious signals induced by fire damage. In addition, the effects of combustion products, manual firefighting efforts, and the activation of automatic fire suppression systems should be assessed.

C9. The FHA may need to produce fire related parameters (temperatures, pressures, and air velocities) for evaluating radioactive material dispersion through the facility air distribution system as a result of fire. The radiological consequences should then be determined as part of the integrated safety assessment.

C10. The quantity and associated hazards of flammable and combustible material that can be expected to be found within the fire area should be factored into the analyses. Consideration should also be given to the presence of transient combustibles associated with maintenance activities and storage. Average combustible loading, by itself, should not be used to estimate fire area fire severity. As a minimum, for each designated fire area, the following fire hazards should be evaluated for potential fire severity and consequent damage:

1. Fire load from solid combustible materials (both quantity and configuration) including those materials of construction, in-situ materials, and anticipated transient combustible materials. Combustibles are defined as materials which do not meet the definition of noncombustible material as presented in NFPA Standard 220. For the purposes of the fire load survey, combustibles which can be classified as limited-combustible (as per NFPA 220) may be so classified. In performing the fire loading survey, the end uses of the survey in the FHA and/or ISA should be kept in mind. These uses may include, but not be limited to: determining or verifying the proper design basis of the fire suppression system, determining the minimum required fire resistance for barriers, assuring adequate prefire planning, and input to fire propagation or radionuclide transport modeling. Each of these uses may require the data to be presented in different formats or level of detail.

2. Flammable and combustible liquids and gases used in the processes within the fire area (quantities or flow rates);

3. Process chemicals and materials (both quantity and location) that could present a toxic or radiological hazard, or that could significantly affect health or the quality of the environment through a release as a result of a fire emergency; and

4. Potential ignition sources.

C11. The FHA should contain an assessment of facility fire water requirements including capacity, pressure, and storage requirements. The assessment should include a list of water based automatic suppression systems and their maximum demands, interior hose stream requirements, and exterior hydrant requirements. With this assessment, the facility fire water system layout should also be provided, including the locations and characteristics of pumps, lines, tanks, towers, and sectionalizing valves.

C12. For each designated fire area determined to be important to facility fire safety, the FHA should provide input to the ISA regarding the postulated accident sequences caused or aggravated by fire. Either quantitative or qualitative methods may be used. Where quantitative analytical methods are used, all input data and assumptions are documented.

C13. The FHA should define those fire protection systems and procedures that provide reasonable assurance that the defined consequences of an accident sequence will not occur or will be mitigated. The coverage of fire detection and suppression systems should be shown within each fire area. For the identified fire protection measures, the applicant should specify compensatory measures to be implemented on a temporary basis in the event the identified systems are not operable. Both the compensatory measure(s) and the time schedule for implementation should be established.

Most of the guidance in this appendix originated from “The Implementation Guide for Use with DOE Orders 420.1 and 440.1--Fire Safety Program” (G-420.1/B-0, G-440.1/E-0, September 30, 1995). In some cases, the original guidance was modified to reflect specific needs for the mixed oxide (MOX) facility.