High Pressure Core Spray Reliability Study

1   HPCS SYSTEM FAULT TREE

The operational unreliability of the HPCS system was calculated using the simple fault tree model shown in Figure 1. The model was constructed to reflect the failure modes identified in the unplanned demand and cyclic/quarterly test data. The fault tree models a demand to provide core spray to the reactor pressure vessel through an automatic actuation. The fault tree model of the HPCS system consists of two sub-trees for the two major HPCS subsystems: Injection and Emergency power. The following failure modes were developed:

HPCS injection

·   Failure to start, other than the injection valve (FTSI)

·   Failure to start, injection valve (FTSV)

·   Failure to run, other than suction transfer (FTRI)

·   Maintenance-out-of-service of the injection subsystem (MOOSI)

·   Failure to transfer suction to the Condensate Storage Tank (CST) (FTRT)

·   Recovery is modeled for the FTSI and FTRT failure modes.

HPCS emergency power

·   Failure to start diesel generator (FTSD)

·   Failure to start generator breaker (FTSB)

·   Maintenance-out-of-service of the emergency power subsystem (MOOSD)

·   Failure to run diesel generator (FTRD)

·   Recovery is modeled for the FTRD failure mode.

2   HPCS ASSUMPTIONS

The fault tree models shown in Figure 1 present the logic for calculating HPCS system unreliability based on postulated conditions.

For the purposes of quantifying the fault tree, the following conditions were assumed:

·   A demand to provide core spray to the RPV is received by the HPCS system

·   The HPCS system is required to be operable for 8 hours

·   The normal offsite power to the Division III electrical bus is not available

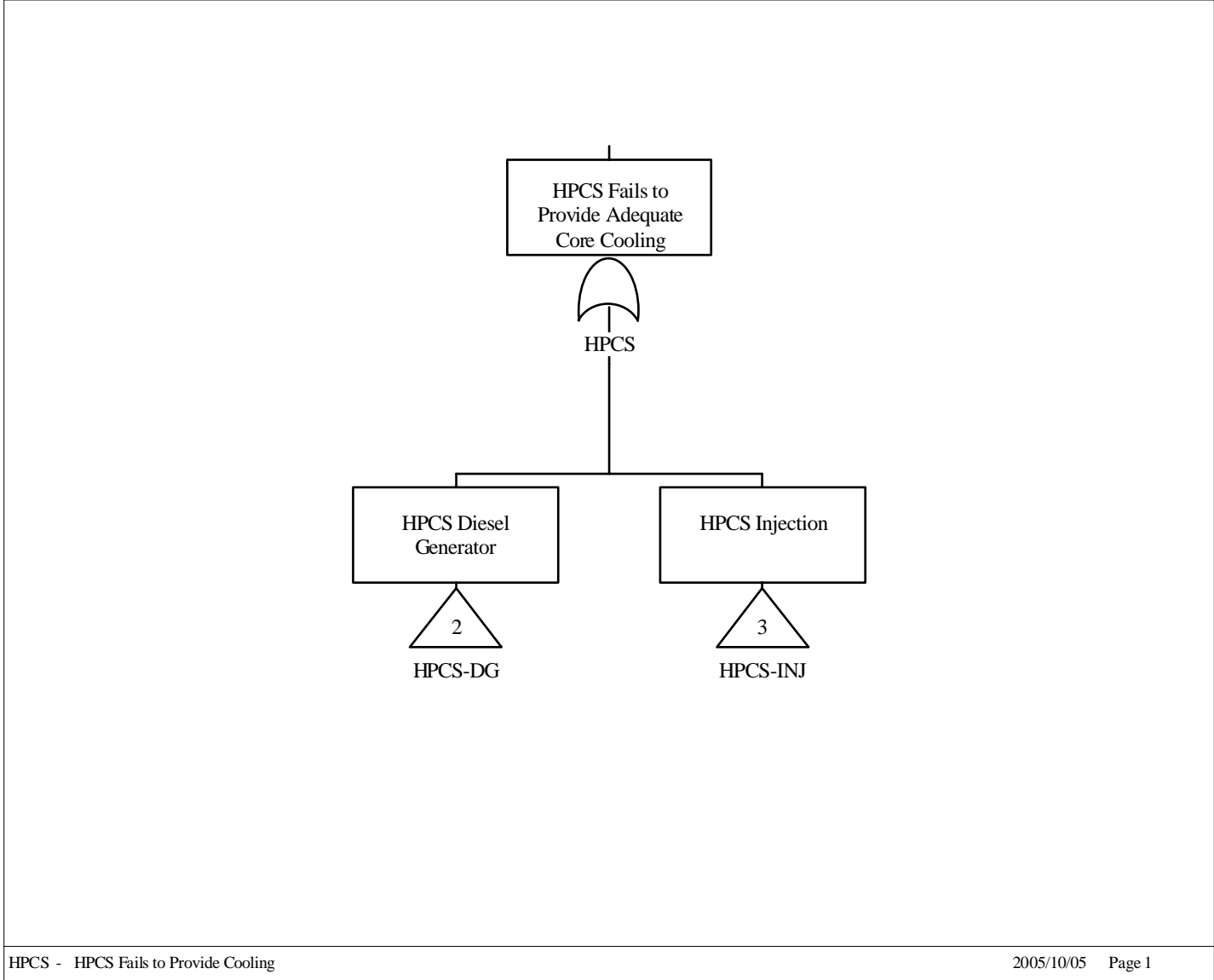·   The HPCS system is assumed to require automatic transfer of suction from the CST to the suppression pool.

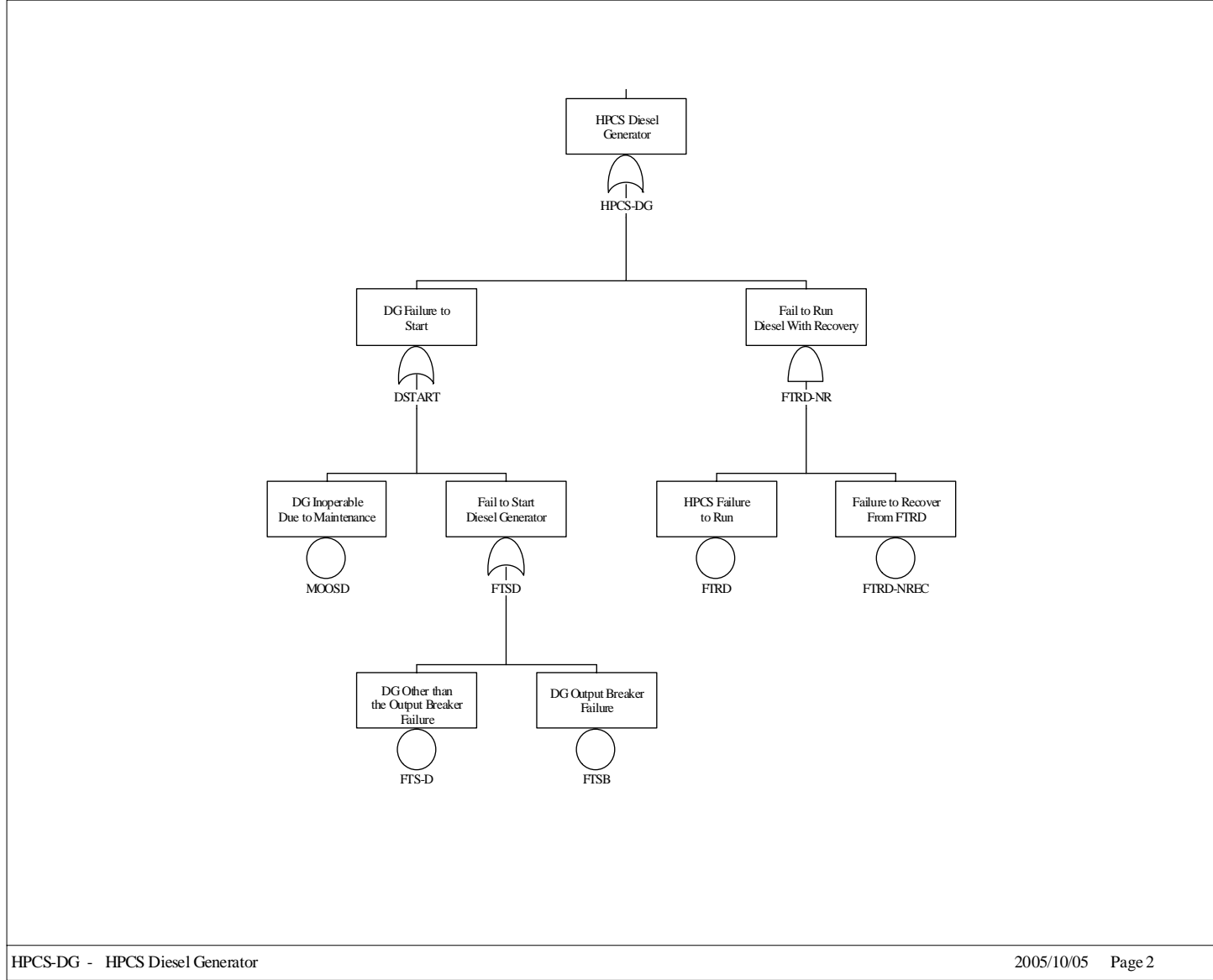**Figure 1. System fault tree of HPCS for calculating operational unreliability.**
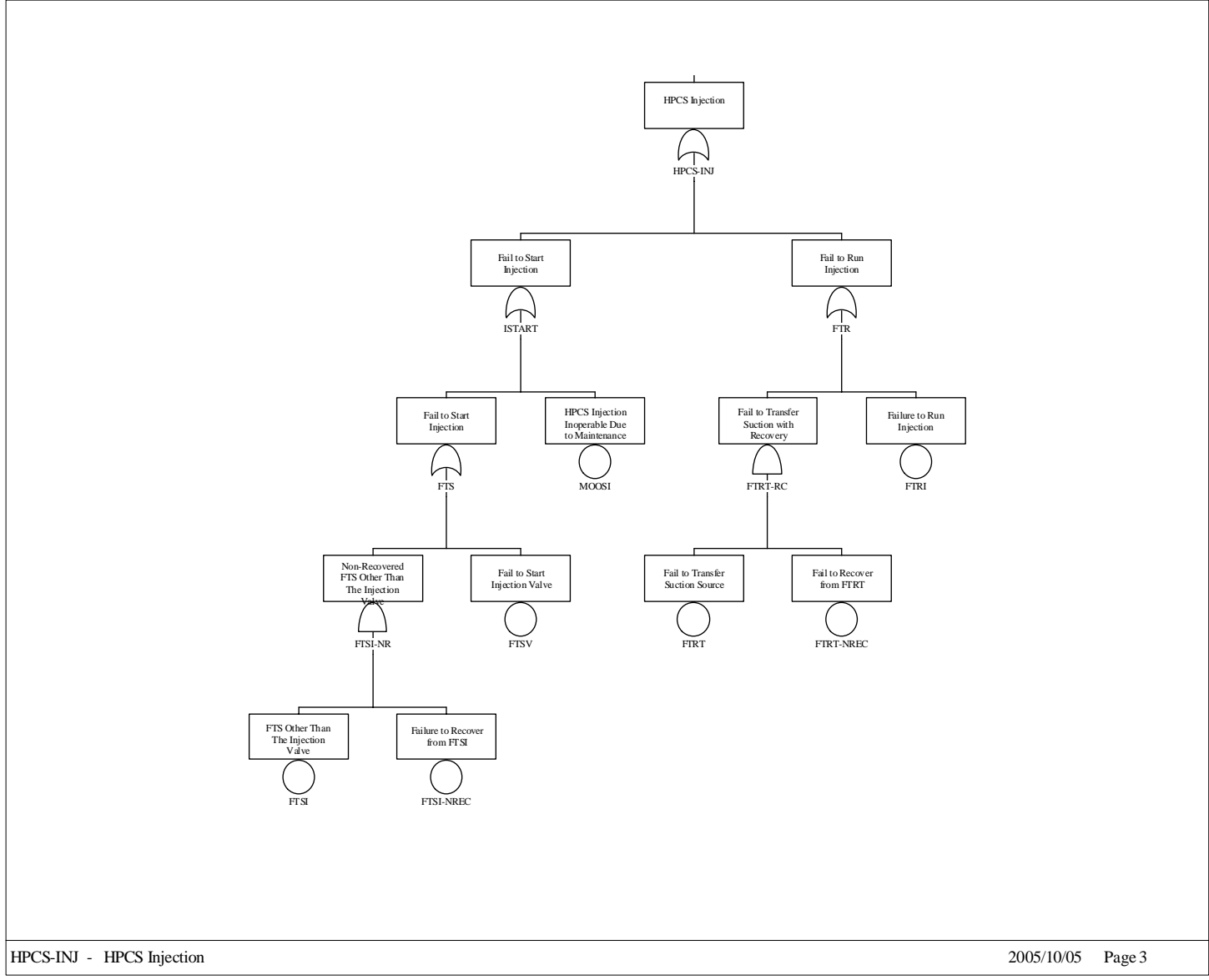
Figure 1. System fault tree of HPCS for calculating operational unreliability. (continued)

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