START HIRI Causal Analysis Tree Rev. 0

- A4 Management Problem-

A1 Design / Engineering

Problem B1 DESIGN INPUT LTA C01 Design input cannot he met C02 Design input obsolete C03 Design input not correct C04 Necessary design input not available B2 DESIGN OUTPUT LTA C01 Design output scope LTA C02 Design output not clear C03 Design output not correct C04 Inconsistent design output C05 Design input not

addressed in design output C06 Drawing, specification or data error C07 Error in equipment or material selection C08 Errors not detectable C09 Errors not recoverable B3 DESIGN /

DOCUMENTATION LTA C01 Design / documentation not complete C02 Design / documentation not up-to-date C03 Design / documentation not controlled

B4 DESIGN / INSTALLATION VERIFICATION LTA C01 Independent review of design / documentation LTA C02 Testing of design / installation LTA C03 Independent inspection of design / installation LTA C04 Acceptance of design / installation LTA

B5 OPERABILITY OF DESIGN / ENVIRONMENT LTA C01 Ergonomics LTA C02 Physical environment LTA C03 Natural environment LTA

B1 SKILL BASED ERROR B1 CALIBRATION FOR C01 Check of work was LTA INSTRUMENTS LTA C02 Step was omitted due to C01 Calibration LTA distraction C02 Equipment found C03 Incorrect performance due to outside acceptance criteria mental lapse C04 Infrequently performed steps were performed incorrectly MAINTENANCE LTA C05 Delay in time cause d LTA actions maintenance for equipment C06 Wrong action selected based on similarity with other actions C02 Predictive maintenance C07 Omission / repeating of steps due to assumptions for completion C04 Equipment history B2 RULE BASED ERROR C01 Strong rule incorrectly chosen over other rules B3 INSPECTION / TESTING C02 Signs to stop were ignored and step performed incorrectly C01 Start-up testing LTA C03 Too much activity was C02 Inspection / testing LTA occurring and error made in C03 Post-maintenance / Postproblem solving modification testing LTA C04 Previous success in use of **B4 MATERIAL CONTROL** rule reinforced continued use of rule C01 Material handling LTA C05 Situation incorrectly C02 Material storage LTA identified or represented result ing C03 Material packaging in wrong rule used B3 KNOWLEDGE BASED C04 Material shipping LTA ERROR C05 Shelf life exceeded C01 Attention was given to wrong C06 Unauthorized material issues C02 LTA Conclusion based on C07 Marking / labeling LTA sequencing of facts B5 PROCUREMENT C03 Individual justifie d action by focusing on biased evidence C01 Control of changes to C04 LTA review based on procurement specifications / assumption that process will not purchase order LTA change C02 Fabricated item did C05 Incorrect assumption that a not meet requirements correlation existed between two or C03 Incorrect item received more facts C04 Product acceptance C06 Individual underestimated the problem by using past events as hacie **B6 DEFECTIVE, FAILED** OR CONTAMINATED B4 WORK PRACTICES LTA C01 Defective or failed part C02 Defective or failed C03 Defective weld, braze

A2 Equipment / Material A3 Human PerformanceLTA

Problem

B2 PERIODIC /

CORRECTIVE

C01 Preventive

C03 Corrective

maintenance LTA

LTA

LTA

LTA

LTA

LTA

LTA

substitution

CONTROL LTA

requirements LTA

or soldering joint

C04 End of life failure

material

noise

C01 Individual's capability to perform work LTA [Examples include: Sensory / perceptual capabilities LTA, Motor / physical capabilities LTA, and Attitude / psychological profile LTA.] C02 Deliberate violation

C05 Electrical or instrument C06 Contaminant

B1 MANAGEMENT METHODS

LTA C01 Management policy guidance/ expectations not well-defined. understood or enforced C02 Job performance standards not adequately defined C03 Management direction created insufficient awareness of impact of actions on safety / reliability C04 Management follow-up or monitoring of activities did not identify problems C05 Management assessment did not determine causes of previous event or known problem C06 Previous industry or in-house experience was not effectively used to prevent recurrence C07 Responsibility of personnel not well-defined or personnel not held accountable C08 Corrective action responses to a known or repetitive problem was untimely C09 Corrective action for previously identified problem or event was not adequate to prevent recurrence B2 RESOURCE MANAGEMENT LTA C01 Too many administrative duties assigned to immediate supervisor C02 Insufficient supervisory resources to provide necessary supervision C03 Insufficient manpower to support identified goal / objective C04 Resources not provided to assure adequate training was provided / maintained C05 Needed resource changes not approved / funded C06 Means not provided to assure procedures / documents / records were of adequate quality and up -to-date C07 Means not provided for assuring adequate availability of appropriate materials / tools C08 Means not provided for assuring adequate equipment quality. reliability, or operability C09 Personnel selection did not assure match of worker motivations / job descriptions C10 Means / method not provided for assuring adequate quality of contract services

C01 Insufficient time for worker to prepare task C02 Insufficient time allotted for task C03 Duties not well-distributed among personnel C04 Too few workers assigned to task C05 Insufficient number of trained or experienced workers assigned to task C06 Planning not coordinated with inputs from Walk downs/ task analysis C07 Job scoping did not identify potential task interruptions and / or environmental stress C08 Job scoping did not identify special circumstances and / or conditions C09 Work planning not coordinated with all departments involved in task C10 Problem performing repetitive tasks and / or subtasks C11 Inadequate work package preparation B4 SUPERVISORY METHODS LTA C01 Tasks and individual accountability not made clear to worker C02 Progress / status of task not adequately tracked C03 Appropriate level of in-task supervision not determined prior to task C04 Direct supervisory involvement in task interfered with overview role C05 Emphasis on schedule exceeded emphasis on methods / doing a good job C06 Job performance and self-checking standards not properly communicated C07 Too many concurrent tasks assigned to worker C08 Frequent job or task "shuffling" C09 Assignment did not consider worker's need to use higher-order skills C10 Assignment did not consider worker's previous task C11 Assignment did not consider worker's ingrained work natterns C12 Contact with personnel too infrequent to detect work habit/attitude changes C13 Provided feedback on negative performance but not on positive performance B5 CHANGE MANAGEMENT LTA C01 Problem identification did not identify need for change C02 Change not implemented in timely manner C03 Inadequate vendor support of change C04 Risks / consequences associated with change not adequately reviewed / assessed C05 System interactions not considered C06 Personnel / department interactions not considered C07 Effects of change on schedules not adequately addressed C08 Change-related training / retraining not performed or not adequate C09 Change-related documents not developed or revised C10 Change-related equipment not provided or not revised C11 Changes not adequately communicated C12 Change not identifiable during task C13 Accuracy / effectiveness of change not verified or not validated

B3 WORK ORGANIZATION & PLANNING LTA

B1 WRITTEN COMMUNICATIONS METHOD OF PRESENTATION LTA C01 Format deficiencies C02 Improper referencing or branching C03 Checklist LTA C04 Deficiencies in user aids (charts etc.) C05 Recent changes not made apparent to user C06 Instruction step / information in wrong sequence C07 Unclear / complex wording B3 TRAINING or grammar **B2 WRITTEN** COMMUNICATION CONTENT LTA C01 Limit inaccuracies C02 Difficult to implement C03 Data / computations wrong / incomplete C04 Equipment identification LTA C05 Ambiguous instructions / requirements C06 Typographical error C07 Facts wrong / requirements not correct C08 Incomplete / situation not covered C09 Wrong revision used **B3 WRITTEN** COMMUNICATION NOT USED C01 Lack of written communication C02 Not available or inconvenient for use B4 VERBAL COMMUNICATION LTA C01 Communication between work groups LTA C02 Shift communications LTA C03 Correct terminology not used C04 Verification / repeat back not used C05 Information sent but not understood C06 Suspected problems not communicated to supervision

C07 No communication

method available

PROVIDED C01 Decision not to train C02 Training requirements not identified C03 Work incorrectly considered "skill of the craft" **B2 TRAINING METHODS** LTA C01 Practice or hands -on experience LTA C02 Testing LTA C03 Refresher training LTA C04 Inadequate presentation MATERIAL LTA

B1 NO TRAINING

A5 Communications LTA A6 Training Deficiency

C01 Training objectives LTA C02 Inadequate content C03 Training on new work methods LTA C04 Performance standards LTA

A7 Other Problem-

B1 EXTERNAL PHENOMENA C01 Weather or ambient conditions LTA C02 Power failure or transient C03 External fire or explosion C04 Other natural phenomena LTA

B2 RADIOLOGICAL / HAZARDOUS MATERIAL PROBLEM C01 Legacy contamination C02 Source unknown

> Level A nodes are underlined. Level B nodes are in ALLCAPS. Level C nodes are in "sentence case." LTA = Less than adequate