APET Methodology for Defense Waste Processing Facility: Mode C Operation

by

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APET METHODOLOGY FOR DEFENSE WASTE PROCESSING FACILITY:
MODE C OPERATION

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ABSTRACT

The Savannah River Site [SRS] Defense Waste Processing Facility [DWPF] is a facility designed to convert the waste currently stored in tanks at the 200-Area tank farm into a form that is suitable for long term storage in engineered surface facilities and ultimately geologic isolation. The DWPF is currently undergoing cold chemical runs and some limited construction preparatory to hot startup in 1995. A Safety Analysis Report [SAR] has been prepared for the facility which describes postulated accidents and consequences of operation.[1] The usual practice in preparation of Safety Analysis Reports is to include a conservative analysis of certain 'design basis accidents'.

The methodology used to determine the risk of operation of the DWPF borrows heavily from methods applied to the Probabilistic Safety Assessment of SRS reactors and to some commercial reactors.[2] Risk of operation is associated with the breach of confinement barriers. The primary barrier to the release of fission products is the vessel or piping containing the waste that is being processed. The remaining barrier to the release of fission products is the confinement system which includes the buildings housing the process and the filter/ventilation systems. The potential consequences of an accident in the DWPF is determined by the systematic tracking of the progression of the accident in terms of the extent of damage to the confinement barriers. Accident progression analysis involves the application of logic models, supplemented by mechanistic evaluations, to track possible accident sequences from the initiating event, through damage to the primary confinement barrier and to the final state of the confinement system. The principal goal of the analysis is to evaluate the success of the confinement system in mitigating the release of fission products to the environment.

The Accident Progression Event Tree or APET, provides a probabilistic representation of potential sequences along which an accident may progress. The fundamental objective of the APET is to evaluate the success of the confinement system in mitigating releases. The APET consists of questions that are phenomenologically oriented and address important aspects of accident progression as well as questions that address the integrity and performance of the confinement system. Each question in the APET is analogous to a top event in a classical event tree. The possible answers to the questions are specified in terms of two or more discrete outcomes represented as branches. The probability that a particular branch is taken is evaluated based on the answers to previous questions [i.e., accident progression is sequence dependent] and on mechanistic analysis of accident progression and confinement response.

Use of the EVNTRE/APET for modeling of accidents in the DWPF involves a significant departure from the methodology developed for reactor analysis as described in Reference 2. The APET does describe the sequence of events that may occur following an accident initiating failure as in conventional EVNTRE/APET methodology. However, it also determines the frequency of certain internally initiated energetic events. This determination is made by analysis of the cut sets for fault trees of systems in which failure can cause energetic events, using the capability of EVNTRE to interchange information with an external FORTRAN program.

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ACRONYMS

APET	Accident Progression Event Tree
CPC	Chemical Processing Cell
CPCV	Chemical Process Cell Vent
LFL	Lower Flammability Limit
LPPP	Low Point Pump Pit
MFT	Melter Feed Tank
MOG	Melter Offgas System
OEV	Organic Evaporator Vessel
OECT	Organic Evaporator Condensate Tank
OWST	Organic Waste Storage Tank
PR	Precipitate Reactor
PRFT	Precipitate Reactor Feed Tank
PRBT	Precipitate Reactor Bottoms Tank
PVVH	Process Vessel Vent Header
PPPT	Pump Pit Precipitate Tank
PPPC	Pump Pit Precipitate Cell
PPST	Pump Pit Sludge Tank
PPSC	Pump Pit Sludge Cell
PPRT	Pump Pit Recycle Tank
PHA	Precipitate Hydrolysis Aqueous
RCT	Recycle Collection Tank
RPC	Remote Process Cell
SPCV	Salt Process Cell Vent
SRS	Savannah River Site
SAR	Safety Analysis Report

ACRONYMS (continued)

SPC	Salt Processing Cell
SME	Slurry Mix Evaporator
SRAT	Sludge Receipt and Adjustment Tank

1. INTRODUCTION

Safe operation of SRS facilities continues to be the highest priority of the Savannah River Site [SRS]. One of these facilities, the Defense Waste Processing Facility or DWPF, is currently undergoing cold chemical runs to verify the design and construction preparatory to hot startup in 1995. The DWPF is a facility designed to convert the waste currently stored in tanks at the 200-Area tank farm into a form that is suitable for long term storage in engineered surface facilities and, ultimately, geologic isolation. As a part of the program to ensure safe operation of the DWPF the Safety Analysis Engineering Section of E&CSD has completed a Probabilistic Safety Assessment of the DWPF. The results of this analysis are incorporated into the Safety Analysis Report [SAR] for DWPF.[1] The usual practice in preparation of Safety Analysis Reports is to include only a conservative analysis of certain 'design basis accidents'.

A major part of a Probabilistic Safety Assessment is the development and quantification of an Accident Progression Event Tree or APET. The APET provides a probabilistic representation of potential sequences along which an accident may progress. The methodology used to determine the risk of operation of the DWPF borrows heavily from methods applied to the Probabilistic Safety Assessment of SRS reactors and to some commercial reactors.[2] This report describes the Accident Progression Event Tree developed for the Probabilistic Safety Assessment of the DWPF.

2. SUMMARY

In the Defense Waste Processing Facility [DWPF] there are three barriers to the release of fission products to the environment: the process vessels and piping [the primary barrier], the DWPF buildings, and the ventilation/filter system. These last two barriers are equivalent to the Confinement System of an SRS reactor and are so designated in this report. In the unlikely event of an accident that breaches the primary barrier, radionuclides will be released into the process cells and building. The main accidents of concern at DWPF are energetic events due to deflagration or detonation of the hydrogen and benzene vapors produced in the process vessels at DWPF during waste processing operations. In order to determine the consequences of an accident, systematic tracking is required of the progression of the accident from the time of the event or events leading to the breach of the primary barrier until the plant is in a stable state. The principal goals of the accident progression analysis are:

- [1] to evaluate the performance of the Confinement System in mitigating the release of fission products to the environment and
- [2] to provide sufficient information such that the magnitude of any release to the environment can be estimated as well as the timing and energy associated with that release.

The logic model used to describe the progression of the accident and determine the success [or failure] of the confinement system in mitigating the consequences of an accident is called an Accident Progression Event Tree or APET. The APET described in this document is based on Salt Processing Cell (SPC) Mode C. This is the full radioactive mode processing.

2.1 The Accident Progression Event Tree

The APET that was developed for DWPF contains 193 events [or questions] that detail the possible progression of postulated accidents. In general, the APET incorporates sufficient detail so that the answers to questions leading up to any point in the accident progression supply information adequate to [1] provide a reasonable estimate of the outcome of the next event considered or [2] establish bounding conditions for the use of mechanistic calculations to provide the answer.

In the development of the APET a series of events [questions] was postulated that could occur during progression of the accident. In general these events pertain to

- [1] the cause of the accident [i.e., initiating event],
- [2] the status of the plant at the time of the accident,
- [3] the energetics of the accident,
- [4] the impact of the accident on adjacent equipment/processes, and
- [5] the response of the Confinement System to the challenge posed by the energetics accompanying the accident and/or the radionuclides that breach the primary barrier.

A probability of occurrence [branch point probability] is associated with each outcome of each event or question in the APET. The sequence of outcomes then determines the course of the accident with an associated probability of occurrence and is referred to as an accident progression sequence. An accident progression sequence is a specific set of events associated with the accident and the subsequent performance of the Confinement System in mitigating the consequences of the accident.

2.2 Quantification of the APET

Determination of the probability of each outcome [branch point probability] is the major effort in the quantification of the APET. The probability that a particular branch is taken is evaluated based on

- [1] known information related to the condition of the facility or the accident under consideration,
- [2] fault tree analysis of active systems within the facility,
- [3] the answers to previous questions [i.e., accident progression is sequence dependent], and/or
- [4] mechanistic analysis of accident phenomena and confinement response.

Once the branch probabilities for all questions are determined, solution of the APET is performed using the EVNTRE program [2].

The result of quantifying the APET is an estimate of the relative frequency of the various accident progression sequences. A potential radionuclide release to the environment, or source term, can be associated with each accident progression sequence defined by the APET. The magnitude and content of the source term will depend on the course of the accident and performance of the confinement system. However, the tens of thousands of source terms that can result from a single quantification of the APET are still too many for further analysis of consequence. Therefore, the accident sequences that have similar characteristics, in terms of the radionuclide source to the environment are grouped or "binned". Nineteen characteristics

[analogous to top events in the APET] are used in the source term binner. These source term bins are used in quantifying the risk of operation of DWPF[3].

3.0 SUMMARY DESCRIPTION OF THE DEFENSE WASTE PROCESSING FACILITIES

This section provides a summary description of the DWPF to aid in understanding the logic model for the progression of severe accidents. The following paragraphs present a brief description of the DWPF at SRS. The descriptive information for the DWPF, which is extracted from the DWPF SAR [1], is brief and is intended only to orient the reader with the process.

3.1 The Confinement System

The primary barrier to the release of radionuclides from the DWPF is the process vessels and associated piping that contain the radioactive waste. The secondary barrier to release of radionuclides is designated "the Confinement System". The Confinement System for the DWPF [equivalent to the Zone 1 ventilation system as described in the SAR] operates on a principle similar to that used for the SRS reactors: an enclosed confinement volume, a once through ventilation system that maintains the pressure in the confinement volume lower than atmospheric, and a filter system to remove radionuclides that may be in the exhausted air. The confinement volume is mainly at and above grade and enclosed by a steel reinforced concrete structure. The exhaust fans are located downstream of the sand filters, both at grade level. The exhaust air is discharged through an ~150-ft. stack.

3.2 The Salt Process Cell

Radioactive waste from the production of nuclear materials at the Savannah River Site is currently stored in large underground tanks. This waste consists of two parts, an insoluble sludge and a supernatant liquid containing soluble salts. The most abundant radioactive element in the supernate is cesium-137, although some strontium-90 and plutonium are also present. The cesium-137 is removed from the supernate by adding sodium tetraphenylborate to precipitate the Cs-137. Sodium titanate is added to the supernate to adsorb the Sr-90 and Pu. The resulting solution is filtered, producing a decontaminated liquid which is converted to saltstone and interred in large engineered disposal buildings located in Z-Area. The remaining precipitate slurry, which has been concentrated, is the feed material to the precipitate hydrolysis process. The precipitate is primarily an organic material.

The precipitate hydrolysis process is conducted in the Salt Process Cell [SPC] in the Vitrification Building or Canyon of the DWPF. Precipitate hydrolysis decomposes the precipitate slurry into two components: an organic stream low in radioactivity and an aqueous stream that contains most of the radioactive material [Cs-137, Sr-90, and Pu]. The organic stream is primarily benzene which is transferred to the Organic Waste Storage Tank [OWST]. The aqueous stream is transferred to the Chemical Process Cell for further treatment before eventual transfer to the glass melter.

The principal hazard of concern in the SPC and its associated vessels is deflagration or detonation of the benzene vapors that are produced during the precipitate hydrolysis process. The approach used to prevent these events is to exclude oxygen from the vapor space in each

vessel in the SPC by use of carbon dioxide or nitrogen purges. Each vessel is provided with a primary and backup carbon dioxide purge and a backup nitrogen purge.

3.3 The Chemical Process Cell

The precipitate slurry from the 200-Area tank farm is separated into two streams by the precipitate hydrolysis process in the Salt Process Cell: an organic stream low in radioactivity and an aqueous stream that contains the bulk of the radioactive material. The organic stream is primarily benzene which is eventually transferred to the Organic Waste Storage Tank [OWST]. The aqueous stream [called Precipitate Hydrolysis Aqueous or PHA] is transferred to the Precipitate Reactor Bottoms Tank [PRBT] in the Chemical Process Cell for storage and subsequent transfer to the Sludge Receipt Adjustment Tank.

The Sludge Receipt Adjustment Tank [SRAT] receives washed sludge slurry from the 200-Area tank farm via the Low Point Pump Pit. Formic acid is added to the sludge slurry in the SRAT to reduce mercury to the elemental state for recovery and minimize gas evolution in the glass melter. After the sludge has been properly adjusted by addition of formic acid the aqueous solution from the Salt Process Cell [PHA] is added in controlled amounts from the PRBT. The quantity of PHA added is determined by the solids content and by the required ratio of precipitate solids to sludge solids. The adjusted sludge-precipitate slurry is transferred from the SRAT to the Slurry Mix Evaporator [SME].

In the SME the remaining operations necessary to prepare a batch of precipitate-sludge slurry for the glass melter are completed. Glass frit is added to the SME to achieve a slurry containing 28 wt% waste solids and 72 wt% glass frit. Excess liquid is evaporated to achieve a total solids content of 50 wt% in the concentrated slurry. After cool down the concentrated slurry is transferred to the Melter Feed Tank.

The principal hazard of concern in the CPC vessels is deflagration or detonation of the benzene and/or hydrogen vapors that are present in the vessels. The approach used to prevent these events is to provide sufficient purge flow to prevent the buildup of flammable concentrations of these vapors in the vessel vapor spaces. Each vessel is provided with a primary compressed air purge and a backup nitrogen purge. The flammability problems associated with each CPC vessel are slightly different and are discussed in more detail below.

The PRBT has continual evolution of hydrogen due to radiolysis of the water in the vessel. Some benzene is also sent to the tank from the PR. The purge flow provided to the vessel from the primary or backup purge systems is sufficient to prevent a flammable mixture from these sources. However, operator errors involving transfer of high benzene content material from the PR to the PRBT could cause benzene vapor generation rates large enough to reach LFL even with the purge systems functioning. The fault tree for the PRBT explosion models all of these mechanisms.

The SRAT has a radiolysis source of hydrogen generation also. Normal amounts of benzene transferred from the PRBT are boiled off with steam during the transfer process from the PRBT. The purge flow provided to the vessel from the primary or backup purge systems is sufficient to prevent a flammable mixture from these sources. In addition, improper additions of material from the PRBT, or excess formic or nitric acid additions can cause hydrogen generation rates large enough to reach LFL even with the purge systems functioning. Propagation of benzene transfer errors from the PR or incorrect boilup of benzene during transfer from the PRBT to the SRAT could also result in benzene vapor generation rates large

enough to reach LFL even with the purge systems functioning. The fault tree for the SRAT explosion models all of these mechanisms.

The SME has a radiolysis source of hydrogen generation also. The purge flow provided to the vessel from the primary or backup purge systems is sufficient to prevent a flammable mixture from this source. In addition, excess addition of formic acid can cause hydrogen generation rates large enough to reach LFL even with the purge systems functioning. The fault tree for the SME explosion models all of these mechanisms.

The MFT has a radiolysis source of hydrogen generation only. The purge flow provided to the vessel from the primary or backup purge systems is sufficient to prevent a flammable mixture from these sources. The fault tree for the MFT explosion models this mechanism.

3.4 The Melter Cell

The sludge-frit slurry is transferred from the Melter Feed Tank [MFT] located in the Chemical Process Cell to the Melter in the Melter Cell. In the Melter the principal vitrification processes of drying, oxidation, and melting take place.

The Melter is operated continuously with a cold cap [crust] composed of waste calcine and frit that covers most of the melt surface. The sludge-frit slurry is introduced into the melter on top of the cold cap which may be as thick as 6 inches. Water from the slurry is evaporated and drawn off into the offgas system. The glass melt beneath the cold cap is at a temperature of 1050-1150°C. The cold cap melts at the melt-cold cap interface and forms the borosilicate glass waste. The extent to which the cold cap covers the melt is determined by the rate of feed of the sludge-frit slurry. The rate of feed is adjusted so that the cold cap covers about 90% of the surface, allowing gases to escape through the cold cap to the vapor space above.

Thermal convection and continuous flow of argon gas through a dip tube into the melt promote mixing of the molten glass. After an average residence time of about 65 hours in the Melter the molten borosilicate-waste glass is poured into a stainless steel canister using differential pressure pouring [i.e., the pressure in the canister is reduced relative to that in the melter vapor space].

The canister is transferred into the Melt Cell from the cold storage area through a transfer tunnel and placed under the Melter pour spout for filling. The level of glass in the canister and the canister weight are monitored during the filling operation. After filling an inner closure plug is placed in the throat of the canister and it is transferred out of the Melter Cell.

3.5 Organic Waste Storage

Waste organic material, primarily benzene, which is a by-product of the vitrification process is transferred through an above ground pipe from the process cells to a large double walled tank outside the Vitrification Building. The Organic Waste Storage Tank or OWST stores the organics for further disposition.

3.6 The Low Point Pump Pit

This section includes those questions defining events that could occur in the Low Point Pump Pit. Two interarea transfer pipes are provided to transfer the radioactive sludge and the precipitate slurry from the Tank Farm to the DWPF. A third pipe is used to transfer waste from the DWPF that must be recycled through the tank farm. A fourth pipe serves as a spare. All interarea transfers are batch transfers.

Radioactive sludge is transferred from the H-Area tank farm to the Sludge Tank in the Pump Pit approximately twice each week. The tank is monitored during transfer to avoid overfilling. The sludge is transferred from the Low Point Pump Pit to the Sludge Receipt Adjustment Tank as needed.

Precipitate slurry is transferred from the H-Area tank farm to the Precipitate Tank in the Pump Pit approximately four times each week. As for the transfer of sludge the Precipitate Tank is monitored during transfer to avoid overfilling. The precipitate slurry is transferred to the Precipitate Reactor Feed Tank in the Salt Process Cell as needed.

During the Vitrification process wastes accumulate that must be recycled through the tank farm. These wastes are collected in the Recycle Collection Tank in the Chemical Process Cell and transferred to the tank farm via the Recycle Tank in the Low Point Pump Pit.

4. THE ACCIDENT PROGRESSION EVENT TREE

This section presents the logic model, called the Accident Progression Event Tree [APET], for the analysis of postulated accidents in the DWPF. As previously discussed, each question in the APET is analogous to a top event in a conventional event tree. The outcome of each question or event may be dependent on events that have happened previously. Therefore, each question is generally accompanied by logic [called case structure] that [1] separates circumstances for which the outcome probabilities for a question may differ and [2] distinguishes regimes of behavior for the phenomena that may be involved.

4.1 Outcome Probabilities

As previously discussed the EVNTRE[2] program was used to solve the APET. A special user function (UFUN) was written specifically for the DWPF analysis to solve the accident fault tree cut sets [12]. It is therefore necessary that the structure of the APET be compatible with EVNTRE. This structure is seen in the listing of the APET in Appendix A. Also shown in the APET listing is the best estimate value of the outcome probabilities for each question. Where questions have multiple cases the outcome probabilities are shown for each case. The

determination of outcome probabilities is a major task in quantification of the APET. The outcome probabilities may be determined by solution to fault tree cut sets which are accessed from the UFUN subroutine in EVNTRE. Outcome probabilities may simply be determined from answers of previous questions and finally they may be input directly based on mechanistic modeling of accident phenomena or expert engineering judgment. In this solution of the DWPF APET, a significant number of the outcome probabilities that an event will occur are set to 1.0. This is done not because of the known certainty that the outcome must occur but because the probability in question is expected to be close to 1.0, it is conservative, and the technical effort required to determine the actual outcome probability is not justified.

Many of the outcome probabilities used in the EVNTRE solution of the APET were distributed variables. Outcome probabilities that were treated this way are denoted in the text of the document with a ****SAMPLED VARIABLE**** label. For those outcome probabilities the values discussed in the text are best estimate values used for illustration purposes only. These outcome probabilities were determined based on analysis where possible and on engineering judgment where analysis was not available [7]. During the actual APET quantification, a probability distribution was used [4] to represent these outcome probabilities and values from the distribution were sampled and supplied to the APET by running the EVNTRE program in sampling mode. Although not labeled ****SAMPLED VARIABLE**** in the text, it should be understood that the outcome probabilities calculated from the cut set solutions have also had important basic events sampled.

One important feature of the EVNTRE program is the way the outcome probabilities are selected for those questions with multiple cases. As previously discussed the case structure developed for each question separates circumstances for which the outcome probabilities for a question may differ based on the occurrence of prior events in the accident progression model, viz., the answers to prior questions. When the EVNTRE program is examining the cases for a particular question the first case for which the Boolean expression representing each case is 'true' [that is the sequence of events listed in the case structure has occurred] is used as the basis for determining the outcome probabilities for the question. EVNTRE then progresses to the next question. In the event the Boolean expression for none of the sequences in the case structure is 'true' [has occurred] then EVNTRE will default to the last case, which is typically referred to as the 'otherwise' case. In general the approach taken in developing the case structure was to identify, insofar as possible, all sequences having bearing on the question, avoiding use of the default case.

Of particular significance in development of the APET structure is the 'type number' assigned each question. The following information is extracted from Reference 2 to describe question types.

There are eight types of questions that can be processed by EVNTRE. These are permutations of the following:

- [1] whether the answer to the question depends upon the path through the tree,*
- [2] whether the branch split fractions are supplied directly or must be calculated from previously supplied reference parameters, together with comparison parameters, and*
- [3] whether parameters are to be supplied for later use by other questions to calculate branch split fractions.*

Question types 2, 4, 6, and 8 depend upon the path through the tree; question types 5, 6, 7, and 8 use calculated probabilities rather than supplied probabilities; and question types 3, 4, 7, and 8 supply parameters for use by subsequent type 5, 6, 7, and 8 questions.

The following lists describe each question type, along with its attributes:

- Question Type = 1; The branch point probabilities are independent of previous branches and are input by the user,
- Question Type = 2; The branch point probabilities are dependent upon previous branches and are input by the user,
- Question Type = 3; The branch point probabilities are independent of previous branches, the user inputs the branch point probabilities, and inputs parameters used in a later question for internal calculation of branch point probabilities [Question Types 5, 6, 7, or 8].^[a]
- Question Type = 4; The branch point probabilities are dependent upon previous branches, the user inputs the branch point probabilities, and inputs parameters used in a later question for internal calculation of branch point probabilities [Question Types 5, 6, 7, or 8].
- Question Type = 5; The branch point probabilities are independent of previous branches and are calculated internally based on user supplied data.
- Question Type = 6; The branch point probabilities are dependent upon previous branches and are calculated internally based on user supplied data.
- Question Type = 7; The branch point probabilities are independent of previous branches and are calculated internally based on user supplied data. Additionally, parameters used in later questions are read.
- Question Type = 8; The branch point probabilities are dependent upon previous branches and are calculated internally based on user supplied data. additionally, parameters used in later questions are read.

All questions in the APET for the DWPF were Question types 2, 3, 4, 6, or 8; Question types 1, 5, and 7 were not used.

The following Table 1 presents an index of the questions in the APET.

[a] The value of the parameter used is selected on the basis of the outcome probabilities.

Table 1: Accident Progression Event Tree For DWPF

Q #	Question Text	Page
1	What is the accident class?	33
2	If the accident class is 'external' what is the initiating event?	33
3	Is failure of a common [ie.,support] system the initiating event?	38
4	If the accident class is an 'internal' event classified 'leak' what is the frequency of the event?	39
5	If the accident class is an 'internal' event classified 'Misc' what is the frequency of the event?	40
6	If the accident class is crane drop what is the frequency of the event?	39
7	What are the support system failure frequencies and repair times?	41
8	Is the failure of the normal electrical power system an 'accident enabler'?	44
9	Is the failure of the emergency [diesel] electrical power system an 'accident enabler'?	45
10	Does the Instrument Air System fail due to random events?	46
11	Does the Instrument Air System fail due to a seismic event?	47
12	Does the Cooling Tower Common System fail due to random events?	47
13	Does the Cooling Tower Common System fail due to a seismic event?	48
14	Does the Deep Well System fail due to random events?	48
15	Does the Deep Well System fail due to seismic events?	49
16	Does the Cooling Tower System fail due to random events?	49
17	Does the Cooling Tower System fail due to a seismic event?	50
18	Is failure of the Instrument Air System an 'accident enabler'?	50
19	Is the failure of the Cooling Tower Common system an 'accident enabler'?	52
20	Is the failure of the Deep Well system an 'accident enabler'?	53
21	Is failure of the Cooling Tower an 'accident enabler'?	54
22	Is the failure of the process steam system an 'accident enabler'?	55
23	Is the failure of the process cooling water system an 'accident enabler'?	57
24	Is the failure of the Carbon Dioxide Purge System an 'accident enabler'?	58
25	Is failure of the Air Purge System an 'accident enabler'?	59
26	Is failure of the Nitrogen Storage Tank System an 'accident enabler'?	60
27	Is failure of the Chilled Water System an 'accident enabler'?	62
28	Is the failure of the backup CO2 System an 'accident enabler'?	63
29	Is failure of the Bulk Nitrogen System an 'accident enabler'?	64
30	Is the failure of the CPC backup liquid N2 Storage Tank System an 'accident enabler'?	65
31	Is failure of the CPC Nitrogen System an 'accident enabler'?	66
32	Is failure of the LPPP Backup Nitrogen System an 'accident enabler'?	67
33	Is failure of the SPC N2 System an 'accident enabler'?	68
34	Is the failure of the SPC Seismic trigger System an 'accident enabler'?	69
35	Is the failure of the SPC Isolation valve UPS an 'accident enabler'?	70
36	Is there a randomly initiated explosion in a process tank or cell?	71
37	Do the cell covers over the Salt Process Cell dislodge and fall because of a seismic event?	73
38	Does a cell cover fall while being moved by the crane?	73

Table 1: Accident Progression Event Tree For DWPF

Q #	Question Text	Page
39	Do the cell covers that fall in a crane accident strike a tank?	74
40	Do the cell covers that fall in a seismic event strike the PR?	75
41	Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor in the Salt Process Cell?	76
42	Does an explosive concentration accumulate in Precipitate Reactor?	76
43	Does a damaging deflagration/detonation occur in the Precipitate Reactor?	77
44	Do the cell covers that fall in a seismic event strike the OE?	78
45	Does a Seismic event or cover crane fall rupture and spill the contents of the Organic Evaporator in the Salt Process Cell?	79
46	Does an explosive concentration accumulate in Organic Evaporator Tank?	79
47	Does a detonation/deflagration of the Organic Evaporator tank occur?	80
48	Do the cell covers that fall in a seismic event strike the OECT?	81
49	Does a Seismic event or cover crane fall rupture and spill the contents of the Organic Evaporator Condensate Tank in the Salt Process Cell?	82
50	Does an explosive concentration accumulate in Organic Evaporator Condensate Tank?	82
51	Does a detonation/deflagration of the Organic Evaporator Condensate tank occur?	83
52	Do the cell covers that fall in a seismic event or crane accident strike the PRFT?	84
53	Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor Feed Tank in the Salt Process Cell?	85
54	Does an explosive concentration accumulate in Precipitate Reactor Feed Tank?	86
55	Does a detonation/deflagration occur in the Precipitate Reactor Feed Tank?	87
56	Do the cell covers for the Chemical Process Cell dislodge and fall following a Seismic event?	87
57	Do the cell covers that fall in a seismic event strike the PRBT?	88
58	Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor Bottoms Tank in the Chemical Process Cell?	89
59	Does an explosive concentration accumulate in the Precipitate Reactor Bottoms Tank [PRBT]?	89
60	Does a detonation/deflagration occur in the Precipitate Reactor Bottoms Tank [PRBT]?	90
61	Do the cell covers that fall due to a seismic event strike the SME?	91
62	Does a Seismic event or cover crane fall rupture and spill the contents of the Slurry Mix Evaporator Tank in the Chemical Process Cell?	92
63	Does an explosive concentration accumulate in the Slurry Mix Evaporator Tank [SME]?	92
64	Does a detonation/deflagration occur in the Slurry Mix Evaporator Tank [SME]?	93
65	Do the cell covers that fall in a seismic event strike the SRAT?	94
66	Does a Seismic event or cover crane fall rupture and spill the contents of the Sludge Receipt and Adjustment Tank in the Chemical Process Cell?	95

Table 1: Accident Progression Event Tree For DWPF

Q #	Question Text	Page
67	Does an explosive concentration accumulate in the Sludge Receipt and Adjustment Tank [SRAT]?	95
68	Does a detonation/deflagration occur in the Sludge Receipt and Adjustment Tank [SRAT]?	96
69	Do the cell covers that fall in a seismic event strike the RCT?	97
70	Does a Seismic event or cover crane fall rupture and spill the contents of the Recycle Collection Tank in the Chemical Process Cell?	98
71	Do the cell covers that fall in a seismic event strike the MFT?	98
72	Does a Seismic event or cover crane fall rupture and spill the contents of the Melter Feed Tank in the Chemical Process Cell?	99
73	Does an explosive concentration accumulate in the Melter Feed Tank [MFT]?	100
74	Does a detonation/deflagration occur in the Melter Feed Tank [MFT]?	101
75	Does a damaging explosion occur in the Salt Process Cell Vent System[SPCV]?	101
76	Does a damaging explosion occur in the Chemical Process Cell Vent System[CPCV]?	102
77	Does an explosive concentration accumulate in the Process Vessel Vent Header [PVVH]?	103
78	Does a damaging detonation occur in the Process Vessel Vent Header [PVVH]?	104
79	Does an explosive concentration accumulate in Precipitate Reactor?	105
80	Does a deflagration/detonation occur in the Precipitate Reactor?	106
81	Does an explosive concentration accumulate in Organic Evaporator Tank?	107
82	Does a detonation/deflagration of the Organic Evaporator tank occur?	108
83	Does an explosive concentration accumulate in Organic Evaporator Condensate Tank?	109
84	Does a detonation/deflagration of the Organic Evaporator Condensate tank occur?	110
85	Does an explosive concentration accumulate in Precipitate Reactor Feed Tank?	111
86	Does a detonation/deflagration occur in the Precipitate Reactor Feed Tank?	112
87	Does an explosive concentration accumulate in the Precipitate Reactor Bottoms Tank [PRBT]?	113
88	Does a detonation/deflagration occur in the Precipitate Reactor Bottoms Tank [PRBT]?	114
89	Does an explosive concentration accumulate in the Slurry Mix Evaporator Tank [SME]?	115
90	Does a detonation/deflagration occur in the Slurry Mix Evaporator Tank [SME]?	116
91	Does an explosive concentration accumulate in the Sludge Receipt and Adjustment Tank [SRAT]?	117
92	Does a detonation/deflagration occur in the Sludge Receipt and Adjustment Tank [SRAT]?	118

Table 1: Accident Progression Event Tree For DWPF

Q #	Question Text	Page
93	Does an explosive concentration accumulate in the Melter Feed Tank [MFT]?	119
94	Does a detonation/deflagration occur in the Melter Feed Tank [MFT]?	120
95	Does a damaging explosion occur in the Salt Process Cell Vent System[SPCV]?	121
96	Does a damaging explosion occur in the Chemical Process Cell Vent System[CPCV]?	122
97	Does an energetic event in the SPC fail the removable wall between the SPC and the CPC?	123
98	Do the cell covers for the Chemical Process Cell dislodge and fall following an energetic event?	123
99	Does splashing [spillage] of the Precipitate Reactor Bottoms Tank contents occur?	124
100	Does splashing [spillage] of the Slurry Mix Evaporator Tank contents occur?	125
101	Does splashing [spillage] of the Sludge Receipt and Adjustment Tank contents occur?	127
102	Does splashing [spillage] of the Recycle Collection Tank contents occur?	128
103	Does splashing [spillage] of the Melter Feed Tank contents occur?	129
104	Does an energetic event in the CPC fail the removable wall between the SPC and the CPC?	130
105	Do the cell covers for the Salt Process Cell dislodge and fall following an energetic event?	130
106	Does splashing [spillage] of the Precipitate Reactor contents occur?	131
107	Does splashing [spillage] of the contents of the Organic Evaporator tank occur?	132
108	Does splashing [spillage] of the contents of the Organic Evaporator Condensate tank occur?	133
109	Does splashing [spillage] of the contents of the Precipitate Reactor Feed Tank occur?	135
110	Does the Vitrification Building collapse following a seismic event?	136
111	Does the Sand Filter function following a seismic event?	136
112	Do the Building Exhaust Ducts from Zone 1 to the Sand Filter function following a seismic event?	137
113	What is the condition of the Zone 1 Exhaust Fan System?	138
114	Does a deflagratable concentration occur in the SPC due to Vessel Overpressurization?	140
115	Does a vessel overpressurization in the Salt Process Cell result in a deflagration in the Salt Process Cell?	141
116	Do the cell covers for the Salt Process Cell dislodge after the overpressurization deflagration?	142
117	Does splashing [spillage] of the Precipitate Reactor contents occur?	142
118	Does splashing [spillage] of the contents of the Organic Evaporator tank occur?	143
119	Does splashing [spillage] of the contents of the Organic Evaporator Condensate tank occur?	143

Table 1: Accident Progression Event Tree For DWPF

Q #	Question Text	Page
120	Does splashing [spillage] of the contents of the Precipitate Reactor Feed Tank occur?	144
121	Does the collateral damage in the Salt Process Cell result in a deflagration in the Salt Process Cell?	145
122	Does the collateral damage in the Salt Process Cell result in a fire in the Salt Process Cell?	147
123	Does a detonation/deflagration occur in the Precipitate Reactor?	149
124	Does a detonation/deflagration of the Organic Evaporator tank occur?	150
125	Does a detonation/deflagration of the Organic Evaporator Condensate tank occur?	151
126	Does a detonation/deflagration occur in the Precipitate Reactor Feed Tank?	152
127	Does a damaging explosion occur in the Salt Process Cell Vent System[SPCV]?	153
128	Do the cell covers for the Salt Process Cell dislodge and fall?	154
129	Does a damaging detonation occur in the Process Vessel Vent Header [PVVH]?	155
130	Does a detonation/deflagration occur in the Precipitate Reactor Bottoms Tank [PRBT]?	156
131	Does a detonation/deflagration occur in the Slurry Mix Evaporator Tank [SME]?	157
132	Does a detonation/deflagration occur in the Sludge Receipt and Adjustment Tank [SRAT]?	158
133	Does a detonation/deflagration occur in the Melter Feed Tank [MFT]?	159
134	Does a detonation occur in the CPC Vent system?	160
135	Does an energetic event in the CPC fail the removable wall between the SPC and the CPC?	161
136	Does splashing [spillage] of the Precipitate Reactor contents occur?	162
137	Does splashing [spillage] of the contents of the Organic Evaporator tank occur?	163
138	Does splashing [spillage] of the contents of the Organic Evaporator Condensate tank occur?	164
139	Does splashing [spillage] of the contents of the Precipitate Reactor Feed Tank occur?	165
140	Does an energetic event in the SPC fail the removable wall between the SPC and the CPC?	166
141	Do the cell covers for the Chemical Process Cell dislodge and fall following an energetic event?	167
142	Does splashing [spillage] of the Precipitate Reactor Bottoms Tank contents occur?	168
143	Does splashing [spillage] of the Slurry Mix Evaporator Tank contents occur?	169
144	Does splashing [spillage] of the Sludge Receipt and Adjustment Tank contents occur?	170
145	Does splashing [spillage] of the Recycle Collection Tank contents occur?	171

Table 1: Accident Progression Event Tree For DWPF

Q#	Question Text	Page
146	Does splashing [spillage] of the Melter Feed Tank contents occur?	172
147	Does a deflagration in the SPC lead to a deflagration in the RPC that damages the building?	173
148	Do the cell covers over the Melter Cell dislodge and fall because of a seismic event?	174
149	Do the cell covers that fall in a seismic event strike the Melter?	175
150	Does a Seismic event rupture and spill the contents of the Melter in the Melter Cell?	175
151	Does a Seismic event rupture the Melter Offgas System in the Melter Cell?	176
152	Does an explosive concentration exist in the Melter Offgas System?	176
153	Does a damaging detonation occur in the Melter Offgas System?	177
154	Does a damaging steam explosion occur due to a salt/water reaction in the Melter?	178
155	Does a damaging reaction occur in the Melter?	179
156	Do the cell covers for the Melter Cell dislodge and fall following an energetic event?	180
157	Does splashing [spillage] of the Melter contents occur as the result of energetic events in the Melter Cell?	181
158	Does a Seismic event or a tornado rupture and spill the contents of the Organic Waste Storage Tank?	182
159	Does an explosive concentration accumulate in the Organic Waste Storage Tank?	183
160	Does a damaging deflagration occur in the Organic Waste Storage Tank [OWST]?	184
161	Does splashing [spillage] of the Organic Waste Storage Tank [OWST] contents occur?	185
162	Do the cell covers over the Low Point Pump Pit dislodge and fall because of a seismic event (i.e., covers over all three cells)?	185
163	Do the cell covers that fall due to a seismic event strike a vessel in the LPPP?	186
164	Does a Seismic event rupture and spill the contents of the Precipitate tank in the Low Point Pump Pit?	186
165	Does an explosive concentration accumulate in the Precipitate tank in the Low Point Pump Pit?	187
166	Does a damaging detonation/deflagration occur in the Precipitate tank in the Low Point Pump Pit?	188
167	Does splashing [spillage] of the Pump Pit Precipitate Tank contents occur?	189
168	Does an explosive concentration accumulate in Pump Pit Precipitate Tank Cell?	190
169	Does a damaging detonation/deflagration occur in the Pump Pit Precipitate Tank Cell?	190
170	Do the cell covers for the Pump Pit Precipitate Cell dislodge and fall following an energetic event?	191
171	Does splashing [spillage] of the Pump Pit Precipitate Tank contents occur?	192

Table 1: Accident Progression Event Tree For DWPF

Q #	Question Text	Page
172	Does a Seismic event rupture and spill the contents of the Sludge tank in the Low Point Pump Pit?	193
173	Does an explosive concentration accumulate in Pump Pit Sludge Tank?	193
174	Does a damaging detonation/deflagration occur in the Pump Pit Sludge Tank?	194
175	Does splashing [spillage] of the Pump Pit Sludge Tank contents occur?	195
176	Does an explosive concentration accumulate in Pump Pit Sludge Cell?	196
177	Does a damaging detonation/deflagration occur in the Pump Pit Sludge Tank Cell?	197
178	Do the cell covers for the Pump Pit Sludge Cell dislodge and fall following an energetic event?	197
179	Does splashing [spillage] of the Pump Pit Sludge Tank contents occur?	198
180	Does a Seismic event rupture and spill the contents of the Recycle tank in the Low Point Pump Pit?	199
181	Does splashing [spillage] of the Pump Pit Recycle Tank contents occur?	199
182	Does an uncontrolled reaction occur in the CPC?	200
183	Does an uncontrolled reaction occur in the SPC?	201
184	Does a vessel overflow occur in the CPC?	201
185	Does a vessel overflow of process material occur in the SPC?	201
186	Does a vessel overflow of benzene occur in the SPC?	202
187	Does a vessel overflow occur in the Low Point Pump Pit?	202
188	Does a leak occur in the Chemical Process Cell?	203
189	Does a leak of process material occur in the Salt Process Cell?	203
190	Does a leak of benzene occur in the Salt Process Cell?	204
191	Does an incidental leak occur in the Pump Pits?	204
192	Does the rupture of a filled storage canister occur?	205
193	What is the status of the ventilation for the Low Point Pump Pit Building?	205

4.2 Summary Outline of DWPF APET

The following outline summarizes the major sections of the Mode C DWPF APET:

1. Questions 1-7: Selection of accident class, data input and initiating event frequencies.
2. Questions 8-35: Support systems status
3. Question 36: Probability of random explosion
4. Questions 37-78:
 - Rupture question for each tank in SPC and CPC for seismic or crane drop
 - First series of explosion questions for each tank for seismic or internal energetic events
 - Explosion question for vent headers
5. Questions 79- 96: These questions are the second series of tank explosions as a result of an initial explosion and propagation through vent headers.
6. Questions 97-109: Failed walls, fallen covers and splashed tank questions for SPC and CPC (from first and second series of explosion questions).
7. Questions 110-112: Building condition as a result of seismic event
8. Questions 113: Condition of zone 1 exhaust fan system.
9. Questions 114-115: Salt cell deflagration #1 (due to vessel over pressurization).
10. Questions 116 - 120: SPC covers falling and tank splashing a result of cell deflagration #1.
11. Questions 121-122: Salt cell deflagration #2 and/or fire as a result of benzene in cell from splashed tanks, leaks or overflows.
12. Questions 123-129: Third series of explosion progression questions and covers falling as a result of SPC deflagration #2.
13. Questions 130-135: Explosion progressions in CPC and wall failure as a result of SPC deflagration #2 (third round).
14. Questions 136-139: Tank splashing in SPC as a result of covers falling or wall failure (from third round).
15. Questions 140: SPC wall failure from third round of explosions
16. Question 141: CPC covers fall (from third round).
17. Questions 142-146: Tank splashing in CPC as a result of covers falling or wall failure (from third round).
18. Question 147: RPC deflagration.

19. Questions 148 - 157: Melter and melter offgas accidents
20. Questions 158-161: OWSST accidents
21. Questions 162-163: LPPP cover displacement as a result of seismic event.
22. Questions 164-171: Seismic or explosion damage in PPPC or PPPT.
23. Questions 172-179: Seismic or explosion damage in PPSC or PPST.
24. Questions 180-181: Seismic damage to PPRT.
25. Questions 182-193: Miscellaneous events.

The APET treats five different accident classes. These are: 1) Internal-Energetic events, 2) External events (seismic initiator only), 3) Crane load drop accidents, 4) Leaks and spills and 5) miscellaneous accident. The accident class to be considered is specified in question one. The attached flow charts illustrate the logical structure and sequence of questions for each accident class in the APET.

During operation, the DWPF is subject to equipment failures that may result in the release of radionuclides to the environment. These equipment failures may be the result of some event external to the DWPF or they may be the result of random failure or personnel error. The first 36 questions in the APET define the events or failures that initiate the accident and the state of the plant at the time of the accident. The chart in Figure 1 shows the first portion of the APET which sets up the problem to be solved by inputting specific information required for solution and then establishes the status of the various support systems. For seismic events, data input includes seismic fragilities and 96 hr. mission time failure rates also called random failure rates. These are used by the APET in selected questions from 8 to 36 to calculate the unavailability of a system after the seismic event. The APET uses this calculation later to determine explosion frequencies. The individual fragilities are also used where the APET specifically inquires about the probability of the failure of a individual component (e.g., a tank). For the internal energetic and other accidents, accident initiator frequencies (i.e. system failure rates) are input in questions 3-6. Support system status is also calculated for these accidents in questions 8 - 36.

System failures are classified as either initiators or enablers. An initiator is an event that must be included in the set of postulated failures and errors which combine in the analysis to produce the accident of concern. In a way they can be thought of as events that could start the sequence of events ending in an accident, although fault tree analysis per se does not deal with time sequences. A component initiator failure may directly result in a facility accident if a redundant or supporting component is offline at the same time. The offline component is said to have failed as an enabler because its lack of availability allows the accident to occur if an initiator has failed. Failure of an enabler alone is not sufficient to cause an accident. It is possible for a system to fail as both an initiator or an enabler on different paths through the APET. Backup systems can only fail as enablers since the failure of the primary system is also required to lose the function provided by the two systems. For example, normal electrical power can fail as an initiator or an enabler. Backup power can only fail as an enabler. Failure of backup power by itself cannot lead to an accident because normal power would still be available. Initiating failure frequencies are input directly to the APET. The status of the various systems as enablers is therefore important and is determined using either logical dependencies or, given data for the failure frequencies and repair times, the UAVAIL subroutine of EVNTRE

calculates the frequency of failure as enabler [11]. Once the setup portion of the APET is complete, the APET begins the necessary logical questions required to determine the progression sequences that may follow an initiating accident.

Figure 2 illustrates the sequence of questions used by the APET for the various internal energetic events. Each box represents a series of questions regarding the outcome of possible events. These are in the order that the APET treats them. Explosions, which can be detonations or deflagrations, may occur randomly or as a result of a common system failure whose failure frequency is input in question 3. The UFUN subroutine [12] is used to obtain fault tree calculations giving the frequency of explosive concentrations. Explosive concentrations of both hydrogen and benzene are considered depending on the vessel [5]. UFUN determines the frequency of an explosive concentration with an ignition source and the conditional probability of an explosive concentration without an ignition source. The possibility of explosions is considered in the Salt Process Cell (from benzene vapor clouds), and the tanks of the Salt, Chemical, Melter cells, the Low Point Pump Pit and the OWST.

Figures 3 through 5 subdivide the flow chart in Figure 2 to more easily illustrate the possible internal energetic progressions in the APET. Figure 3 shows the progressions in the SPC and the CPC. The initiator and enabler information is input and then a 1st round or series of questions is initiated to determine the frequencies of tank explosions. Both detonations and deflagrations are considered probable with deflagrations considered far more likely. The order of the questions is not important as there is no dependency among the tanks. Any individual or multiple tank explosions results in a flame front propagated into the cell vent headers and the process vent headers. This means that an ignition source is instantaneously available to other tanks in either cell and additional progression is possible. This propagation becomes the ignition source for additional explosions if conditions in other tanks are favorable for ignition but had not exploded initially because there was no ignition source present. This is a second round of explosions. Again the order of the secondary explosion is not important as the propagation of the flame front through the headers is considered instantaneous. For accidents initiated by tank explosions, it is assumed that all possibilities for explosions have been exhausted as a result of the initial event because there are no more ignition sources. The results of SPC/CPC explosions are: 1) tank detonations rupture a tank and possibly adjacent tanks, and/or 2) falling cell covers, a collapsing wall or flying shrapnel that rupture tanks resulting in releases. As a result of benzene spills and subsequent vapor cloud formation possible in the SPC from the OEV and/or the OECT, there may be a deflagration within the cell. The cell deflagration may cause a SPC fire. There is no propagation into the CPC because at this time the vent headers have already been destroyed by the fallen salt process cell covers. The progressions may ultimately lead to a deflagration in the RPC if there had not been a fire because the initial cell deflagration pushes a cloud of benzene into the RPC. The RPC deflagration is assumed to result in significant damage to the building and to release the contents of all vessels.

Figure 4 shows the progression for the melter cell, the low point pump pit and OWST which are separate from the SPC and CPC. Progressions from the SPC/CPC to these areas are not considered feasible. In the melter cell, releases may occur from the melter vessel or the melter offgas system, either one of which may explode. The melter offgas system may accumulate an explosive concentration that may detonate in the presence of an ignition source. In the melter tank, a salt and water reaction may cause an explosion. An explosion in the melter will cause the melter cell covers to fall resulting in possible releases. Source term releases are possible from the melter offgas system and the melter. In the LPPP only the precipitate and sludge tanks can explode. A detonation or falling cell covers can release the tank contents. The

OWST is outside the vitrification building and releases its contents as a result of a deflagration alone.

Another progression that can occur is illustrated in Figure 5. In this case, if the SPC is isolated and the nitrogen system overpressurises the tanks forcing benzene vapor into the cell, a simultaneous failure of the ventilation system allows a buildup of benzene vapor in the cell. If an explosive concentration develops and an ignition source is available, an explosion in the cell can result. This can be further propagated if tanks containing benzene are splashed leading to a second cell deflagration, SPC tank explosions and then ultimately to a possible RPC deflagration.

Figure 6 shows the modeled progressions for a seismic event. Again the APET establishes the support system status before beginning the accident progression questions. The seismic event may have several immediate outcomes: 1) cell covers fall and rupture tanks, 2) tanks are ruptured by the seismic event, 3) support system damage leads to explosions, 4) zone 1 ventilation system failure and 5) major damage to the building. Figure 6 is subdivided in Figures 7 through 10 to illustrate the various progressions possible. In Figure 7, several progressions or combinations can occur. Tanks can be ruptured as a result of dislodged cell covers or the direct effect of the seismic event. If the OEV and/or the OECT are splashed the benzene released can lead to cell deflagrations. The more likely sequence is a tank explosion in the SPC or CPC that basically results in the same series of progressions as shown in Figure 3. All progressions may result in an RPC deflagration. In Figure 8, tanks in the melter cell, the LPPP and the OWST are subject to releases because of ruptures or explosions. Finally in Figure 9, the progression is shown where loss of zone 1 fans causes a SPC overpressure deflagration and possibly an RPC deflagration.

Figure 10 shows the progression of events considered in the accident where a heavy object (cell cover) is dropped while being moved by a crane. Operations are procedurally suspended during maintenance requiring crane operations with heavy objects but tanks are not necessarily empty. Before overhead operations with the crane are allowed to commence, the benzene tanks are de-inventoried such that the total release of these contents will not overflow the SPC sump. If a tank is struck, it is assumed that it is ruptured and the contents are released. If the SPC ventilation has failed at the same time a potential exists for a cell deflagration and/or a fire. No additional propagation is assumed beyond the cell deflagration.

Figure 11 shows the progression of events considered if a tank leak occurs. If the release and a zone 1 fan failure occur simultaneously then the possibility a SPC deflagration and/or fire exists.

Miscellaneous events include an uncontrolled reaction in a chemical process cell vessel, an uncontrolled reaction in the precipitate reactor in the salt process cell and unintentional injection of water into the melter. Figure 12 shows that the miscellaneous categories do not lead to additional progressions.

Figure 1. Initial Setup Questions for DWPF APET

Figure 2. Internal Energetic Events

Figure 3. Progressions in SPC and CPC

Figure 4. Progression in Melter, LPPP, OWST

Figure 5. Zone 1 Ventilation Failure Progression

Figure 6. Seismic Progressions

Figure 7. Seismic Progression in SPC and CPC

Figure 8. Seismic Progression in Melter, LPP and OWST

Figure 9. Zone 1 Ventilation Failure Progression Seismic

Figure 10. Crane Drop Accident Progressions

Figure 11. Leak Progressions

Figure 12. Miscellaneous

4.3 APET Method

The APET can be visualized as a very large event tree with 193 questions (top events). Questions are permitted to have more than 2 responses (branches). Boolean expressions utilizing the answers to previous questions in the APET can be constructed so that the path through the tree can be dependent on answers to previous questions.

Information about the frequency of explosions of the DWPF tanks and systems that have been modeled are provided to the APET from the cut sets that resulted from quantification of the internal and seismic fault trees for these systems. The DWPF User Function (UFUN) is a FORTRAN subroutine designed to be used during quantification of the DWPF APET by the EVNTRE computer code. The UFUN provides an interface between the APET and the processed individual accident fault tree solution files that are provided as input. Given the status of the various DWPF support systems, it selects and solves the appropriate cut sets from the fault tree solutions. The UFUN also has the capability to read information from the Latin Hypercube Sample (LHS) file so that events in the cut sets can be sampled as part of an uncertainty analysis.

The determination of outcome probabilities is a major task in quantification of the APET. As described above the outcome probabilities may be determined by solution of fault tree cut sets which are accessed from the UFUN subroutine in EVNTRE. Outcome probabilities may simply be determined from answers of previous questions and finally they may be input directly based on mechanistic modeling of accident phenomena or expert engineering judgment.

Each path (accident progression sequence) through the tree is followed until either it reaches the end of the tree or until the sequence frequency drops below a truncation value ($1.0\text{E-}12$ per hour was used for the DWPF quantifications). Quantification of the APET can result in several hundred thousand to more than a million accident progression sequences depending on the particular accident class being modeled. The many sequences that result indicate far more detail about accident progression than can be assessed. Consequently, sequences from the APET are grouped or binned based on similar characteristics or attributes in the accident progression. The result of the sequence binning process can be visualized as a much smaller event tree whose sequences are each an accident progression bin. The cut set that corresponds to each sequence is then a listing of the bin attributes. Although the number of accident progression bins may still be extensive [tens of thousands], they represent a substantial reduction from the total number of accident progression sequences developed by solution of the APET.

4.4 Explanation of the APET Questions.

The following sections describe the questions and associated case structure for the APET. Reference should be made to the EVNTRE input file presented in Appendix A for additional information on the case structure.

Question 1: What is the accident class?

In the development of the APET it was beneficial to categorize the postulated accidents into different classes depending on the initiating event and the expected system response to the initiating event [e.g., potential for release of energy and for progression of the accident]. There are five defined outcomes as follows:

External:	This accident class includes all initiating events that are external to the DWPF [e.g., seismic, wind, flood, aircraft crashes].
Int-Egy:	This accident class includes all initiating events that are caused by failure of systems internal to the DWPF and that are expected to result in a significant release of energy.
LtdLeak:	This accident class includes all initiating events that result in a leak of process material in the DWPF whose consequences are expected to be limited.
LtdMisc:	This accident class includes a number of initiating events that are not process material leaks whose consequences are expected to be limited.
LtdCD:	This accident class includes events whose initiator is a drop of a load from an overhead crane in the DWPF facility. In this analysis, the load is assumed to be a cell cover that has been removed in the facility.

This is a Type 3 question and the outcome probabilities are input. An outcome probability of 1.0 is specified for the particular class of accidents to be analyzed. All other outcome probabilities are specified as 0.0. The answer to this question is used in the logic to determine the outcome probabilities in questions throughout the event tree. This question is also used to specify a control parameter used in solution of the APET as follows:

Arg [90]:	LHS, control parameter that indicates the Latin Hypercube sample being used.

The above parameter is used in determining the outcome of Questions 42, 46, 50, 54, 59, 63, 67, 73, 77, 79, 81, 83, 85, 87, 89, 91, 93, 114, 152, 154, 159, 165, 168, 173, and 176.

Question 2: If the accident class is 'external' what is the initiating event?

The answer to this question defines the type of external initiating event. There are eight outcomes defined for this question as follows:

- nExtrnl: This outcome is selected if the initiating event is not an external event, i.e., the outcome of Question 1 is other than Branch 1.
- E1-Seis: This outcome is selected if the external initiating event is a seismic event.
- E2-Wind: This outcome is selected if the external initiating event is a high wind.
- E3-Flood: This outcome is selected if the external initiating event is a flood.
- E4-Other: This outcome is selected if the external initiating event is an undefined external event.
- E5-Heli: This outcome is selected if the external initiating event is the crash of a helicopter into the facility.
- E6-Plane: This outcome is selected if the external initiating event is the crash of an airplane into the facility.
- E7-Vhcle: This outcome is selected if the external initiating event is the crash of a ground vehicle into the facility.

[For the Mode C safety analysis for the DWPF only the seismic event was considered as an initiating event. The rest of the branches are included only as place holders.]

The answers to this question depend upon the outcome of previous Question 1 and are used in the logic to determine the outcome probabilities in questions throughout the event tree. Three cases are used to develop the outcome probabilities on the basis of the outcome of Question 1 as follows:

- Case 1 This case includes those sequences in which the accident class is either an internal-energetic event, a limited leak, limited miscellaneous event or crane load drop accident from Question 1. The outcome probability is 1.0 in Branch 1.
- Case 2 This case includes the sequences in which the accident class is an external event. The outcome probability is 1.0 in Branch 2.
- Case 3 The default outcome probability is 1.0 in Branch 1.

This is a Type 4 question and is also used to define sixty three [63] parameters, primarily external event fragilities, used in the quantification of the APET. These parameters, whose value will depend on the question outcomes, are defined as follows (The source of fragility values shown in the APET in Appendix A are summarized in Reference 4.):

- Arg [1]: MsTmEx, a constant used in calculating the failure of support systems for 96 hours after the external event. In the Mode C analysis this parameter is always set equal to 1.0 because the support system fault trees were solved with a 96 hour mission time rather than on a per hour basis.
- Arg [2]: NPwrFr, the external event fragility of the normal electrical power system.

- Arg [3]: EPwrFr, the external event fragility of the emergency electrical power system.
- Arg [4]: PStmFr, the external event fragility of the process steam system.
- Arg [5]: PCWFr, the external event fragility of the process cooling water system.
- Arg [6]: CO2Fr, the external event fragility of the SPC primary CO₂ purge system.
- Arg [7]: AirFr, the external event fragility of the CPC primary air purge system.
- Arg [8]: N2TkFr, the external event fragility of the bulk liquid nitrogen storage tank system.
- Arg [9]: ChWFr, the external event fragility of the chilled water system.
- Arg [10]: CoTFr, the external event fragility of the cooling tower pumping system.
- Arg [11]: BCO2Fr, the external event fragility of the SPC backup CO₂ purge system.
- Arg [12]: CanyClps, the external event fragility for collapse of the canyon.
- Arg [13]: TrigFr, the external event fragility for the SPC seismic trigger.
- Arg [14]: FiltFr, the external event fragility of the sand filter system.
- Arg [15]: DuctFr, the external event fragility of the exhaust duct system.
- Arg [16]: FanFr, the external event fragility of the exhaust fan system.
- Arg [17]: PPPTFr, the external event fragility of the Pump Pit Precipitate Tank.
- Arg [18]: PPSTFr, the external event fragility of the Pump Pit Sludge Tank.
- Arg [19]: PPRTFr, the external event fragility of the Pump Pit Recycle Tank.
- Arg [20]: PRx-Fr, the external event fragility of the Precipitate Reactor.
- Arg [21]: OEV-Fr, the external event fragility of the Organic Evaporator Tank.
- Arg [22]: OECTFr, the external event fragility of the Organic Evaporator Condensate Tank.
- Arg [23]: PRFTFr, the external event fragility of the Precipitate Reactor Feed Tank.
- Arg [24]: PRBTFr, the external event fragility of the Precipitate Reactor Bottoms Tank.
- Arg [25]: SME-Fr, the external event fragility of the Slurry Mix Evaporator Tank.

- Arg [26]: SPCUPSF_r, the external event fragility of the uninterruptible power supply for the SPC vent header isolation valves.
- Arg [27]: SRATF_r, the external event fragility of the Sludge Receipt and Adjustment Tank.
- Arg [28]: RCTF_r, the external event fragility of the Recycle Collection Tank.
- Arg [29]: MFTF_r, the external event fragility of the Melter Feed Tank.
- Arg [30]: MeltF_r, the external event fragility of the melter.
- Arg [31]: OWSTF_r, the external event fragility of the Organic Waste Storage Tank.
- Arg [32]: PPCovF_r, the external event fragility of the Pump Pit Covers.
- Arg [33]: CCovF_r, the external event fragility of the covers for the Salt and Chemical Process Cells.
- Arg [34]: IAirF_r, the external event fragility of the Instrument Air System.
- Arg [72]: BlkN2F_r, the external event fragility of the bulk N2 system.
- Arg [73]: CPCN2F_r, the external event fragility of the CPC nitrogen purge system (backup CPC purge).
- Arg [74]: NPwrR_n, normal power system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [75]: EPwrR_n, emergency power system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [76]: PStmR_n, process steam system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [77]: PCWR_n, process cooling water system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [78]: CO2R_n, SPC primary CO2 purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [80]: AirR_n, CPC primary air purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [81]: N2TkR_n, bulk N2 storage tank system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [82]: ChWR_n, chilled water system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [83]: CoTR_n, cooling tower pumping system random failure probability for the 96 hour mission time assumed after a seismic event.

- Arg [84]: BCO2Rn, SPC backup CO₂ purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [85]: LAirRn, instrument air system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [86]: BlkN2Rn, bulk N₂ purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [87]: CPCN2Rn, CPC backup N₂ purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [96]: FanRn1, Zone 1 ventilation system random failure probability for the 96 hour mission time assumed after a seismic event under the conditions where normal power has failed but diesel power and instrument air are available.
- Arg [97]: CTCmFr, the external event fragility of the cooling tower common system.
- Arg [101]: CTCmRn, cooling tower common system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [102]: DWelFr, the external event fragility of the deep well cooling system.
- Arg [106]: DWelRn, deep well cooling system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [107]: CPCTkFr, the external event fragility of the liquid nitrogen tank for the CPC backup purge system.
- Arg [111]: CPCTkRn, CPC backup purge system liquid nitrogen tank random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [112]: PPN2Fr, the external event fragility of the Pump Pit nitrogen purge system.
- Arg [116]: PPN2Rn, Pump Pit nitrogen purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [117]: SPCN2Fr, the external event fragility of the SPC nitrogen purge system.
- Arg [121]: SPCN2Rn, SPC nitrogen purge system random failure probability for the 96 hour mission time assumed after a seismic event.
- Arg [122]: FanRn2, Zone 1 ventilation system random failure probability for the 96 hour mission time assumed after a seismic event under the conditions where normal power and instrument air have failed but diesel power is still available.

Arg [123]: FanRn3, Zone 1 ventilation system random failure probability for the 96 hour mission time assumed after a seismic event under the conditions where normal power, diesel power, and instrument air are all available.

Arg [129]: MOGFr, the external event fragility of the Melter Offgas System.

Question 3: Is failure of a common [i.e., support] system the initiating event?

The initiating event that results in damage to the DWPF may be caused by a failure of a 'support' system within the DWPF that is common to more than one process system in the DWPF. The defined outcomes are as follows (The initiating frequencies are sampled variables, Reference 8. The ones shown in App A. are placeholders.): ****SAMPLED VARIABLE****

nCoSyIn: The initiating event is other than failure of a common 'support' system.

NPowInit: Failure of the normal electrical power system is the initiating event.

PStmInit: Failure of the process steam system is the initiating event.

IAirInit: Failure of the instrument air system is the initiating event.

CO2Init: Failure of the SPC primary CO2 purge system is the initiating event.

AirInit: Failure of the CPC primary air purge system is the initiating event.

N2TkInit: Failure of the bulk nitrogen storage tank system is the initiating event.

ChWInit: Failure of the chilled water system is the initiating event.

CoTInit: Failure of the cooling tower pumping system is the initiating event.

BlkN2Init: Failure of the bulk nitrogen purge system is the initiating event.

CTCmInit: Failure of the cooling tower common system is the initiating event.

The answers to this question depends upon the outcome of previous Question 1 and are used in the logic to determine the outcome probabilities in Questions 8, 9, 10, 12, 16, 18, 19, 21 through 29, 31, 32, 36, 59, 63, 67, 73, 77, 87, 89, 91, 93, 113, 152, and 193.

Three cases are used to develop the outcome probabilities on the basis of prior events or questions as follows:

Case 1 This case includes those sequences in which the accident class is either an external event, a limited leak, or other limited event from Question 1. The outcome probability is 1.0 in Branch 1.

Case 2 This case includes the sequences in which the accident class is an internal-energetic event. The outcome probability for Branches 2 through 11 are the hourly failure rates determined by failure analysis of the system. The outcome probability for Branch 1 is 1.0 less the sum of all the frequencies in Branches 2 through 11.

Case 3 The default outcome probability is 1.0 in Branch 1.

This is a Type 4 question and defines a parameter used in the quantification of the APET. This parameter, whose value will depend on the question outcomes, is defined as follows:

Arg [35]: MsTmInt, the time in hours required to restore the failed support system to an operational state.

NOTE: This parameter is not used in the Mode C analysis.

Question 4: If the accident class is an 'internal' event classified 'leak' what is the frequency of the event?

If the initiating event is a leak of radioactive material from a process vessel or pipe in the DWPF whose consequences are expected to be limited, this question defines the frequency of the event. Eleven outcomes have been defined as follows (The initiating frequencies shown in the APET in Appendix A are derived from Reference 10):

nIntLeak:	The initiating event is not a leak in DWPF.
Mltr-Leak:	The initiating event is a spill of the contents of the melter. (not used)
CPC-Oflow:	The initiating event is an overflow of a vessel in the Chemical Process Cell.
PP-Oflow:	The initiating event is an overflow of a vessel in the Pump Pit.
CPC-Leak:	The initiating event is a leak from a vessel in the Chemical Process Cell.
SPC-Leak:	The initiating event is a leak from the PR or PRFT in the Salt Process Cell.
PP-Leak:	The initiating event is a leak in the Pump Pit.
Can-Rup:	Waste canister rupture from dropped cell cover, with assumed 1E-03 conditional prob that drop occurs during cannister handling and is struck.
BZ-Oflow:	The initiating event is an overflow from the OEV or the OECT in the Salt Process Cell.
BZ-Leak:	The initiating event is a leak from the OEV or OECT in the Salt Process Cell.
SPC-Oflow:	The initiating event is an overflow from the PR or PRFT in the Salt Process Cell.

This is a Type 2 question. The outcome probabilities for this question depend on the answer to Question 1 and are used in the logic to determine the outcome probabilities in Questions 8, 9, 113, 121, 122, 157, and 184 through 192. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is a limited leak, Branch 3, Question 1. The branch probabilities for Branches 2 through 11 are the hourly frequencies of occurrence of the respective leaks, based on experience in the 200-Area. The outcome probability for Branch 1 is 1.0 less the sum of all the frequencies in Branches 2 through 11.

Case 2 The default outcome probability is 1.0 in Branch 1.

Question 5: If the accident class is an 'internal' event classified 'Misc.' what is the frequency of the event?

This question defines the frequency of those events whose consequences are expected to be limited that are other than leaks. Four outcomes have been defined as follows:

nIntMisc: The initiating event is not a one that is classified as Misc.

CPC-UcR: The initiating event is an uncontrolled reaction in Chemical Process Cell vessel.

I16H2OMI: The initiating event is addition of water to the melter.

PR-UcR: The initiating event is an uncontrolled reaction in the PR in the Salt Process Cell.

This is a Type 2 question. The outcome probabilities for this question depend on the answer to Question 1 and are used in the logic to determine the outcome probabilities in Questions 157, 182, and 183. Two cases are used to develop the outcome probabilities on the basis of prior events as follows (The initiating frequencies shown in the APET in Appendix A are derived from Reference 10. The 'water to the melter' event was included in an earlier version of the DWPF APET but is now known to be an insignificant event and is retained only as a placeholder):

Case 1 This case includes those sequences in which the accident class is a limited miscellaneous event, Branch 4, Question 1. The branch probabilities for Branches 2 through 4 are the hourly frequencies of occurrence of the respective events, based on experience in the 200-Area. The outcome probability for Branch 1 is 1.0 less the sum of all the frequencies in Branches 2 through 4.

Case 2 The default outcome probability is 1.0 in Branch 1.

Question 6: If the accident class is crane drop what is the frequency of the event?

This question defines the frequency of accidents caused by crane load drops. Two outcomes have been defined as follows:

nCraDrop: The initiating event is not a crane load drop.

CraneDrop: The initiating event is a crane load drop. For the purposes of this analysis, the crane load is assumed to be a cell cover.

This is a Type 2 question. The outcome probabilities for this question depend on the answer to Question 1 and are used in the logic to determine the outcome probabilities in Question 38. Two cases are used to develop the outcome probabilities on the basis of prior events as follows (The initiating frequencies shown in the APET in Appendix A are derived from Reference 6):

- Case 1 This case includes those sequences in which the accident class is a limited cranedrop, Branch 5, Question 1. The outcome probability for Branch 2 is the hourly frequency of occurrence of a crane load drop, based on SRS experience. The outcome probability for Branch 1 is 1.0 less the sum of Branch 2.
- Case 2 The default outcome probability is 1.0 in Branch 1.

Question 7: What are the support system failure frequencies and repair times?

This is a Type 4 question and is used to define forty eight parameters for use in quantification of the APET. The values assigned the parameters are dependent on the outcome of Question 1. Three cases are used to define the condition for assigning values to the parameters on the basis of prior events as follows (The failure frequencies (λ) and the repair times (τ) shown in the APET in Appendix A are derived from Reference 5):

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event.
- Case 2 This case includes those sequences in which the accident class is an external event.
- Case 3 This case includes all remaining sequences.

The parameters are as follows:

- Arg [36] NPwrLmda, the hourly failure frequency of the normal electrical power system.
- Arg [37] EPwrLmda, the hourly failure frequency of the emergency electrical power system.
- Arg [38] PStmLmda, the hourly failure frequency of the process steam system.
- Arg [39] PCWLmda, the hourly failure frequency of the process cooling water system.
- Arg [40] CO2Lmda, the hourly failure frequency of the SPC primary CO₂ purge system.
- Arg [41] AirLmda, the hourly failure frequency of the CPC primary air purge system.

- Arg [42] N2TkLmda, the hourly failure frequency of the bulk N₂ storage tank system.
- Arg [43] ChWLmda, the hourly failure frequency of the chilled water system.
- Arg [44] FanLmda1, the hourly failure frequency of the Zone 1 ventilation exhaust fans with normal power failed, diesel power available, and instrument air available.
- Arg [45] IAirLmda, the hourly failure frequency of the instrument air system.
- Arg [46] CoTLmda, the hourly failure frequency of the cooling tower pumping system.
- Arg [47] BCO2Lmda, the hourly failure frequency of the SPC backup CO₂ purge system.
- Arg [48] NPwrTau, the repair time, in hours, of the normal electrical power system.
- Arg [49] EPwrTau, the repair time, in hours, of the emergency electrical power system.
- Arg [50] PStmTau, the repair time, in hours, of the process steam system.
- Arg [51] PCWTau, the repair time, in hours, of the process cooling water system.
- Arg [52] CO2Tau, the repair time, in hours, of the SPC primary CO₂ purge system.
- Arg [53] AirTau, the repair time, in hours, of the CPC primary air purge system.
- Arg [54] N2TkTau, the repair time, in hours, of the bulk N₂ storage tank system.
- Arg [55] ChWTau, the repair time, in hours, of the chilled water system.
- Arg [56] FanTau1, the repair time, in hours, of the Zone 1 ventilation exhaust fans with normal power failed, diesel power available, and instrument air available.
- Arg [57] IAirTau, the repair time, in hours, of the instrument air system.
- Arg [58] CoTTau, the repair time, in hours, of the cooling tower pumping system.
- Arg [59] BCO2Tau, the repair time in hours of the SPC backup CO₂ purge system.
- Arg [79] Dummy, a logical parameter used to force specific outcomes in certain cases in some APET questions.
- Arg [88] BlkN2Lmda, the hourly failure frequency of the bulk N₂ purge system.
- Arg [89] BlkN2Tau, the repair time in hours of the bulk N₂ purge system.
- Arg [91] CPCN2Lmda, the hourly failure frequency of the CPC backup N₂ purge system.

- Arg [92] CPCN2Tau, the repair time in hours of the CPC backup N₂ purge system.
- Arg [99] CTCmLmda, the hourly failure frequency of the cooling tower common system.
- Arg [100] CTCmTau, the repair time in hours of the cooling tower common system.
- Arg [104] DWellmda, the hourly failure frequency of the deep well cooling system.
- Arg [105] DWelTau, the repair time in hours of the deep well cooling system.
- Arg [109] CPCTkLmda, the hourly failure frequency of the CPC backup purge liquid nitrogen storage tank system.
- Arg [110] CPCTkTau, the repair time in hours of the CPC backup purge liquid nitrogen storage tank system.
- Arg [114] PPN2Lmda, the hourly failure frequency of the Pump Pit nitrogen purge system.
- Arg [115] PPN2Tau, the repair time in hours of the Pump Pit nitrogen purge system.
- Arg [119] SPCN2Lmda, the hourly failure frequency of the SPC backup nitrogen purge system.
- Arg [120] SPCN2Tau, the repair time in hours of the SPC backup nitrogen purge system.
- Arg [124] FanLmda2, the hourly failure frequency of the Zone 1 ventilation exhaust fans with normal power failed, diesel power available, and instrument air failed.
- Arg [125] FanTau2, the repair time, in hours, of the Zone 1 ventilation exhaust fans with normal power failed, diesel power available, and instrument air failed.
- Arg [126] FanLmda3, the hourly failure frequency of the Zone 1 ventilation exhaust fans with normal power available, diesel power available, and instrument air available.
- Arg [127] FanTau3, the repair time, in hours, of the Zone 1 ventilation exhaust fans with normal power available, diesel power available, and instrument air available.
- Arg [130] TrigLmda, the hourly failure frequency of the SPC seismic trigger.
- Arg [131] TrigTau, the repair time, in hours, of the SPC seismic trigger.
- Arg [132] SUPSLmda, the hourly failure frequency of the SPC isolation valve uninterruptible power supply.
- Arg [133] SUPSTau, the repair time, in hours, of the SPC isolation valve uninterruptible power supply.

Arg [134] Zero, a logical parameter used to force specific outcomes in certain cases in some APET questions.

As previously indicated the APET for the DWPF is different from the usual accident progression tree using EVNTRE methodology. The APET is used not only to describe accident progression but the event tree and its associated FORTRAN function subroutines includes and solves fault trees for failures leading to accidents in various DWPF systems. Also the APET is organized to present a consistent approach to the analysis of accidents that may occur at the DWPF. This is accomplished in-part by treating common system events explicitly, i.e., they are defined in Questions 8 through 35. These events are necessary to represent dependencies, and consequently, dependent failures among the DWPF system fault trees.

Question 8: Is the failure of the normal electrical power system an 'accident enabler'?

Failure of the normal electric power system can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The normal power system has no dependancies on any other DWPF support systems. There are two defined outcomes as follows:

NPowEn: The normal electric power system fails but does not initiate the accident.

nNPowEn: The normal electric power system does not fail [or its failure has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is also used in calculations to determine the outcome probabilities of later Questions 42, 46, 50, 54, 59, 63, 67, 73, 77, 79, 81, 83, 85, 87, 89, 91, 93, 114, 159, 168, 173, and 176. The parameter is as follows:

Arg [60] FailNPwr, a logical variable that indicates the state of the normal power system. The parameter is assigned a value of {-1.0} if the system has failed as the 'initiator', {+1.0} if the system is failed but not as the 'initiator', and {0.0} if the system is available.

The outcome probabilities for this question depend primarily on the accident class and the reliability of the normal electric power system. They are used in the logic to determine the outcome probabilities in Questions 9, 18, 21, 22, 23, 24, 25, 27, 113, 152, and 193 and are used to determine the value assigned the above parameter. Four cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the normal electric power is an initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailNPwr, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.

Case 2 This case includes those sequences in which the accident class is an internal-energetic event, a limited leak, a limited miscellaneous event, or a crane drop and failure of the normal electric power is not an initiating

event [Question 3]. The outcome probability for Branch 1 is calculated as a function of NPwrLmda and NPwrTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailNPwr, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 3 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of NPwrLmda and NPwrTau, NPwrFr, and NPwrRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailNPwr, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 4 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the normal electric power is not an enabler. The parameter, FailNPwr, is assigned a value of {0.0} when branch 2 is selected.

Question 9: Is the failure of the emergency [diesel] electrical power system an 'accident enabler'?

Failure of the emergency electric power system can contribute to an accident as one of a series of events. Failure of the emergency electric power system can not initiate an accident because it is a backup system and not on-line. The emergency power system has no dependancies on any other DWPF support systems. There are two defined outcomes as follows:

EPowEn: The emergency electric power fails.

nEPowEn: The emergency electric power does not fail.

This is a Type 8 question and defines a parameter that is also used in calculations to determine the outcome probabilities of later Questions 63, 67, 77, 89, 91, 159, 168, 173, and 176. The parameter is as follows:

Arg [61] FailEPwr, a logical variable that indicates the state of the emergency power system. The parameter is assigned a value of {+1.0} if the system is failed and {0.0} if the system is available.

The outcome probabilities for this question depend primarily on the accident class and the reliability of the emergency electric power system. They are used in the logic to determine the outcome probabilities in Questions 18, 23, 27, 113, and 193 and are used to determine the value assigned the above parameter. Four cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and normal electric power has failed, either as an 'initiator' or an 'enabler'. The outcome probability for Branch 1 is calculated as a function of EPwrLmda and EPwrTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailEPwr, is assigned a value of {+1.0} when

Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 2 This case includes sequences in which the accident class is a limited leak, limited crane drop, or limited miscellaneous and the normal power system has failed as an enabler. The outcome probability for Branch 1 is calculated as a function of EPwrLmda and EPwrTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailEPwr, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 3 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated in subroutine UAVAIL as a function of EPwrLmda and EPwrTau, EPwrFr, and EPwrRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailEPwr, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 4 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the emergency electric power is not an accident 'enabler'. The parameter, FailEPwr, is assigned a value of {0.0} when branch 2 is selected.

Question 10: Does the Instrument Air system fail due to random events?

Failure of the instrument air system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

IAirRf: The instrument air system fails due to random events but does not initiate the accident.

nIAirRf : The instrument air system does not fail due to random events.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 18, 19, and 21. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the instrument air system is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of IAirLmda and IAirTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

- Case 2** The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the instrument air system does not occur due to random events.

Question 11: Does the Instrument Air system fail due to a seismic event?

Failure of the instrument air system to function after an external event can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

- IAirSe:** The instrument air system fails due to an external event.
- nIAirSe:** The instrument air system does not fail due to an external event.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the fragility of the system to the external event, and are used in the logic to determine the outcome probabilities in Questions 18, 19, 21. Two cases are used to develop the outcome probabilities on the basis of prior events:

- Case 1** This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of **IAirLmda** and **IAirTau**, **IAirFr**, and **IAirRn** and **MsTmEx**. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 2** The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the instrument air system does not occur due to an external event.

Question 12: Does the Cooling Tower Common system fail due to random events?

Failure of the cooling tower common system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

- CTCmRf:** The cooling tower common system fails due to random events but does not initiate the accident.
- nCTCmRf:** The cooling tower common system does not fail due to random events.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 18 and 21. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1** This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower common system is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of **CTCmLmda**

and CTCmTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1:

- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the cooling tower common system does not occur due to random events.

Question 13: Does the Cooling Tower Common system fail due to a seismic event?

Failure of the cooling tower common system to function after an external event can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

- CTCmSe: The cooling tower common system fails due to an external event.
nCTCmSe: The cooling tower common system does not fail due to an external event.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the fragility of the system to the external event, and are used in the logic to determine the outcome probabilities in Questions 18 and 21. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of CTCmLmda and CTCmTau, CTCmFr, and CTCmRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the cooling tower common system does not occur due to an external event.

Question 14: Does the Deep Well system fail due to random events?

Failure of the deep well cooling system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

- DWelRf: The deep well cooling system fails due to random events.
nDWelRf: The deep well cooling system does not fail due to random events.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 18 and 20. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2]. The outcome probability

for Branch 1 is calculated as a function of DWelLmda and DWelTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the deep well cooling system does not occur due to random events.

Question 15: Does the Deep Well system fail due to seismic events?

Failure of the deep well cooling system to function after an external event can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

DWelSe: The deep well cooling system fails due to an external event.

nDWelSe: The deep well cooling system does not fail due to an external event.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the fragility of the system to the external event and are used in the logic to determine the outcome probabilities in Questions 18 and 20. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of DWelLmda and DWelTau, DWelFr, and DWelRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the deep well cooling system does not occur due to an external event.

Question 16: Does the Cooling Tower system fail due to random events?

Failure of the cooling tower pumping system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

CoTRf: The cooling tower pumping system fails due to random events but does not initiate the accident.

nCoTRf: The cooling tower pumping system does not fail due to random events.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 18 and 21. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower pumping system is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of CoTLmda and CoTTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the cooling tower pumping system does not occur due to random events.

Question 17: Does the Cooling Tower system fail due to a seismic event?

Failure of the cooling tower pumping system to function after an external event can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. There are two defined outcomes as follows:

- CoTSe: The cooling tower pumping system fails due to an external event.
- nCoTSe: The cooling tower pumping system does not fail due to an external event.

This is a Type 6 question. The outcome probabilities for this question depend on the accident class and the fragility of the system to the external event and are used in the logic to determine the outcome probabilities in Questions 18 and 21. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of CoTLmda and CoTTau, CoTFr, and CoTRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the cooling tower pumping system does not occur due to an external event.

Question 18: Is failure of the Instrument Air system an 'accident enabler'?

Failure of the instrument air system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The instrument air system is dependant on the following DWPF support systems: normal and emergency electrical power, and the cooling tower. Total failure of power or failure of the cooling tower system causes failure of the instrument air system. There are two defined outcomes as follows:

- IAirEn: The instrument air system does not function but does not initiate the accident.

nIAirEn: The instrument air system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in calculations to determine the outcome probabilities of later Questions 63, 67, 77, 89, 91, and 152. The parameter is as follows:

Arg [93] FailIAir, a logical variable that indicates the state of the instrument air system. The parameter is assigned a value of {-1.0} if the loss of function of the instrument air system is the 'initiator', {+1.0} if the instrument air system is not functioning but is not the 'initiator', and {0.0} if the instrument air system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 22, 23, 27, and 113 and to determine the value assigned the above parameter. Six cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the instrument air system is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailIAir, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.

Case 2 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower common system is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 1. The parameter, FailIAir, is assigned a value of {1.0} when Branch 1 is selected as the outcome.

Case 3 This case includes those sequences in which the normal and emergency electric power systems are failed. The instrument air system cannot fulfill its function in the event the normal and emergency electric power systems fail. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailIAir, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 4 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and either the cooling water system has failed due to any of its three modeled subsystems (cooling tower common, cooling tower pumping, deep well) or the instrument air system has failed randomly. An outcome probability of 1.0 is assigned to Branch 1. The parameter, FailIAir, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 5 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1] and either the cooling water system has failed due to any of its three modeled subsystems being failed by the external event (cooling tower common, cooling tower pumping, deep well) or the instrument air system has failed due to the external event. An outcome probability of 1.0 is assigned to Branch 1. The parameter,

FailIAir, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

- Case 6 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the instrument air system is not an accident 'enabler'. The parameter, FailIAir, is assigned a value of {0.0} when branch 2 is selected.

Question 19: Is the failure of the Cooling Tower Common system an 'accident enabler'?

Failure of the cooling tower common system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The cooling tower common system is dependant on the instrument air system. Failure of the instrument air system causes the cooling tower common system to fail. There are two defined outcomes as follows:

- CTCmEn: The cooling tower common system does not function but does not initiate the accident.
- nCTCmEn: The cooling tower common system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in calculations to determine the outcome probabilities of later Questions 63, 67, 77, 89, 91, and 152. The parameter is as follows:

- Arg [98] FailCTCm, a logical variable that indicates the state of the cooling tower common system. The parameter is assigned a value of {-1.0} if the loss of function of the cooling tower common system is the 'initiator', {+1.0} if the cooling tower common system is not functioning but is not the 'initiator', and {0.0} if the cooling tower common system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 23 and 27 and to determine the value assigned the above parameter. Five cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower common system is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailCTCm, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the instrument air system is the initiating event [Question 3]. The cooling tower common system cannot perform its function if the instrument air system has failed. The outcome probability for Branch 1 is assigned a

value of 1.0. The parameter, FailCTCm, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

- Case 3 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower common system or the instrument air system due to random events occurs. The outcome probability assigned is 1.0 for Branch 1. The parameter, FailCTCm, is assigned a value of {1.0} when Branch 1 is selected as the outcome.
- Case 4 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1] and the cooling tower common system or the instrument air system have failed due to the external event. The outcome probability for Branch 1 is assigned a value of 1.0. The parameter, FailCTCm, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 5 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the cooling tower common system is not an accident 'enabler'. The parameter, FailCTCm, is assigned a value of {0.0} when branch 2 is selected.

Question 20: Is the failure of the Deep Well system an 'accident enabler'?

Failure of the deep well system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The deep well system has no dependancies on any other DWPF support systems. There are two defined outcomes as follows:

DWelEn: The deep well system does not function.

nDWelEn: The deep well system continues to function.

This is a Type 8 question and defines a parameter that is used in calculations to determine the outcome probabilities of later Questions 63, 67, 77, 89, 91, and 152. The parameter is as follows:

Arg [103] FailDWel, a logical variable that indicates the state of the deep well system. The parameter is assigned a value of {+1.0} if the deep well system is not functioning and {0.0} if the deep well system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 23 and 27 and to determine the value assigned the above parameter. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the deep well system has failed randomly. An outcome probability of 1.0 is assigned to Branch

1. The parameter, FailDWel, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 2 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1] and the deep well system has failed due to the external event. An outcome probability of 1.0 is assigned to Branch 1. The parameter, FailDWel, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 3 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the deep well system is not an accident 'enabler'. The parameter, FailDWel, is assigned a value of {0.0} when branch 2 is selected.

Question 21: Is failure of the Cooling Tower an 'accident enabler'?

Failure of the cooling tower system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The cooling tower system is dependant on the following DWPF support systems: normal electrical power, and instrument air. Failure of normal power or failure of the instrument air system causes failure of the cooling tower system. There are two defined outcomes as follows:

CoTEn: The cooling tower common system does not function but does not initiate the accident.

nCoTEn: The cooling tower common system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in calculations to determine the outcome probabilities of later Questions 63, 67, 77, 89, 91, and 152. The parameter is as follows:

Arg [62] FailCoT, a logical variable that indicates the state of the cooling tower system. The parameter is assigned a value of {-1.0} if the loss of function of the cooling tower is the 'initiator', {+1.0} if the cooling tower is not functioning but is not the 'initiator', and {0.0} if the cooling tower is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 23 and 27 and to determine the value assigned the above parameter. Seven cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailCoT, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.

- Case 2 This case includes those sequences in which the cooling tower common system is failed. The cooling tower cannot fulfill its function in the event the cooling tower common system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailCoT, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 3 This case includes those sequences in which the normal electric power system is failed. The cooling tower cannot fulfill its function in the event the normal electric power system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailCoT, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 4 This case includes those sequences in which the instrument air system is failed. The cooling tower cannot fulfill its function in the event the instrument air system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailCoT, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 5 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the cooling tower is not the initiating event [Question 3] but does fail randomly. The outcome probability for Branch 1 is assigned a value of 1.0. The parameter, FailCoT, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 6 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1] and the cooling tower system, the cooling tower common system, or the instrument air system have failed due to the external event. The outcome probability for Branch 1 is assigned a value of 1.0. The parameter, FailCoT, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 7 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the cooling tower function is not an accident 'enabler'. The parameter, FailCoT, is assigned a value of {0.0} when branch 2 is selected.

Question 22: Is the failure of the process steam system an 'accident enabler'?

Failure of the process steam system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The process steam system is dependant on the following DWPF support systems: normal electrical power and instrument air. Failure of normal power or the instrument air system causes failure of the process steam system. There are two defined outcomes as follows:

PStmEn: The process steam system fails but does not initiate the accident.

nPStmEn: The process steam system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in calculations to determine the outcome probabilities of later Questions 67, 77 and 91. The parameter is as follows:

Arg [63] FailPStm, a logical variable that indicates the state of the process steam system. The parameter is assigned a value of {-1.0} if the loss of function of the process steam system is the 'initiator', {+1.0} if the process steam system is not functioning but is not the 'initiator', and {0.0} if the process steam system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Six cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the process steam is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailPStm, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.

Case 2 This case includes those sequences in which the instrument air system is failed. The process steam system is inoperative if the instrument air system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailPStm, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 3 This case includes those sequences in which the normal electric power system is failed. The process steam system is inoperative if the normal electric power system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailPStm, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 4 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the process steam is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of PStmLmda and PStmTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailPStm, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 5 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of PStmLmda and PStmTau, PStmFr, and PStmRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailPStm, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 6 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the process steam is not an accident 'enabler'. The parameter, FailPStm, is assigned a value of {0.0} when branch 2 is selected.

Question 23: Is the failure of the process cooling water system an 'accident enabler'?

Failure of the process cooling water system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The process cooling water system is dependant on the following DWPF support systems: normal and emergency electrical power, and the cooling tower. Total failure of power or failure of the cooling tower system causes failure of the process cooling water system. There are two defined outcomes as follows:

PCWEn: The process cooling water system fails.

nPCWEn: The process cooling water system continues to function.

This is a Type 8 question and defines a parameter that is used in calculations to determine the outcome probabilities of later Questions 63, 67, 77, 89, and 91. The parameter is as follows:

Arg [64] FailPCW, a logical variable that indicates the state of the process cooling water system. The parameter is assigned a value of {+1.0} if the process cooling water system is not functioning and {0.0} if the process cooling water system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Five cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which both the normal electric power system and the emergency electrical power system are failed. Because the process cooling water system fails in the event of loss of electric power, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailPCW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 2 This case includes those sequences in which the cooling tower common system, the instrument air system, or the cooling tower pumping/deep well systems are failed. The process cooling water system cannot fulfill its function in the event the cooling tower system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailPCW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

Case 3 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2]. The outcome probability for Branch 1 is calculated as a function of PCWLmda and PCWTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailPCW, is assigned a value of {+1.0} when

Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 4 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of PCWLmda and PCWTau, PCWFr, and PCWRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailPCW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 5 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the process cooling water function is not an accident 'enabler'. The parameter, FailPCW, is assigned a value of {0.0} when branch 2 is selected.

Question 24: Is the failure of the Carbon Dioxide Purge System an 'accident enabler'?

Failure of the SPC primary carbon dioxide purge system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The primary carbon dioxide purge system is dependant on the following DWPF support systems: normal electrical power. Failure of normal power causes failure of the primary carbon dioxide purge system. There are two defined outcomes as follows:

CO2En: The SPC primary CO2 purge system fails but does not initiate the accident.

nCO2En: The SPC primary CO2 purge system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 42, 46, 50, 54, 79, 81, 83, and 85. The parameter is as follows:

Arg [65] FailCO2, a logical variable that indicates the state of the CO2 purge system. The parameter is assigned a value of {-1.0} if the loss of function of the CO2 purge system is the 'initiator', {+1.0} if the CO2 purge system is not functioning but is not the 'initiator', and {0.0} if the CO2 purge system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Question 28 and to determine the value assigned the above parameter. Five cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the CO2 purge system is the initiating event [Question 3]. The outcome probability

assigned is 1.0 for Branch 2. The parameter, FailCO2, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.

- Case 2 This case includes those sequences in which the normal electric power system is in a failed state. Because the CO2 purge system fails in the event of loss of electric power an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailCO2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 3 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the CO2 purge system is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of CO2Lmda and CO2Tau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailCO2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of CO2Lmda and CO2Tau, CO2Fr, and CO2Rn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailCO2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 5 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the CO2 purge system is not an accident 'enabler'. The parameter, FailCO2, is assigned a value of {0.0} when branch 2 is selected.

Question 25: Is failure of the Air Purge System an 'accident enabler'?

Failure of the CPC primary air purge system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The primary air purge system is dependant on the following DWPF support system: normal electrical power. Failure of normal power causes failure of the primary air purge system. There are two defined outcomes as follows:

- AirEn: The CPC primary air purge system fails but does not initiate the accident.
- nAirEn: The CPC primary air purge system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 59, 63, 67, 73, 77, 87, 89, 91, and 93. The parameter is as follows:

- Arg [66] FailAir, a logical variable that indicates the state of the air purge system. The parameter is assigned a value of {-1.0} if the loss of function of the

air purge system is the 'initiator', {+1.0} if the air purge system is not functioning but is not the 'initiator', and {0.0} if the air purge system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Five cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the air purge system is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailAir, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.
- Case 2 This case includes those sequences in which the normal electric power system is in a failed state. Because the air purge system fails in the event of loss of electric power an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailAir, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 3 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the air purge system is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of AirLmda and AirTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailAir, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of AirLmda and AirTau, AirFr, and AirRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailAir, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 5 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the air purge system is not an accident 'enabler'. The parameter, FailAir, is assigned a value of {0.0} when branch 2 is selected.

Question 26: Is failure of the Nitrogen Storage Tank System an 'accident enabler'?

The nitrogen storage tank system (also known as bulk nitrogen storage) supplies nitrogen to the bulk N₂ system and is one of the supplies to the CPC backup N₂ system. Failure of the nitrogen storage tank system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The nitrogen storage tank system is not dependant on any other DWPF support systems. There are two defined outcomes as follows:

N2TkEn: The N2 storage tank system fails but does not initiate the accident.

nN2TkEn: The N2 storage tank system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 59, 63, 67, 73, 77, 87, 89, 91, 93, 159, 165, 168, 173, and 176. The parameter is as follows:

Arg [67] FailN2Tk, a logical variable that indicates the state of the N2 storage tank system. The parameter is assigned a value of {-1.0} if the loss of function of the N2 storage tank system is the 'initiator', {+1.0} if the N2 storage tank system is not functioning but is not the 'initiator', and {0.0} if the N2 storage tank system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Questions 29, 31, and 33 and to determine the value assigned the above parameter. Four cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the N2 storage tank system is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailN2Tk, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the N2 storage tank system is not the initiating event [Question 3]. The outcome probability for Branch 1 is calculated as a function of N2TkLmda and N2TkTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailN2Tk, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 3 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of N2TkLmda and N2TkTau, N2TkFr, and N2TkRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailN2Tk, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the N2 storage tank system is not an accident 'enabler'. The parameter, FailN2Tk, is assigned a value of {0.0} when branch 2 is selected.

Question 27: Is failure of the Chilled Water System an 'accident enabler'?

Failure of the chilled water system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The chilled water system is dependant on the following DWPF support systems: normal and emergency electrical power and the cooling tower. Total failure of power or failure of the cooling tower system causes failure of the chilled water system. There are two defined outcomes as follows:

ChWEn: The chilled water system fails but does not initiate the accident.

nChWEn: The chilled water system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Question 77. The parameter is as follows:

Arg [68] FailChW, a logical variable that indicates the state of the chilled water system. The parameter is assigned a value of {-1.0} if the loss of function of the chilled water system is the 'initiator', {+1.0} if the chilled water system is not functioning but is not the 'initiator', and {0.0} if the chilled water system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Six cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1** This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the chilled water is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailChW, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.
- Case 2** This case includes those sequences in which the normal electric power system and the emergency electrical power systems are failed. Because the chilled water system fails in the event of loss of electric power, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailChW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 3** This case includes those sequences in which the cooling tower common system, the instrument air system, or the cooling tower pumping/deep well systems are failed. The chilled water system cannot fulfill its function in the event the cooling tower system fails. Therefore, an outcome probability of 1.0 is assigned to Branch 1. The parameter, FailChW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 4** This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the chilled water system is not the initiating event [Question 3]. The outcome

probability for Branch 1 is calculated as a function of ChWLmda and ChWTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailChW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 5 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of ChWLmda and ChWTau, ChWFr, and ChWRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailChW, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 6 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the chilled is not an accident 'enabler'. The parameter, FailChW, is assigned a value of {0.0} when branch 2 is selected.

Question 28: Is the failure of the backup CO2 System an 'accident enabler'?

Failure of the SPC backup carbon dioxide purge system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The backup carbon dioxide system is not dependant on any of the other DWPF support systems. There are two defined outcomes as follows:

BCO2En: The SPC backup CO2 purge system fails.

nBCO2En: The SPC backup CO2 purge system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 42, 46, 50, 54, 79, 81, 83, and 85. The parameter is as follows:

Arg [69] FailBCO2, a logical variable that indicates the state of the backup CO2 purge system. The parameter is assigned a value of {+1.0} if the backup CO2 purge system is failed and {0.0} if the backup CO2 purge system is available.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the SPC primary CO2 purge system fails either as an initiator or an enabler. The outcome probability for Branch 1 is calculated as a function of BCO2Lmda and BCO2Tau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailBCO2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

- Case 2 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1] and the SPC primary CO₂ purge system fails as an enabler. The outcome probability for Branch 1 is calculated as a function of BCO₂Lmda and BCO₂Tau, BCO₂Fr, and BCO₂Rn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailBCO₂, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 3 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the backup CO₂ purge system is not an accident 'enabler'. The parameter, FailBCO₂, is assigned a value of {0.0} when either branch is selected.

Question 29: Is failure of the Bulk Nitrogen System an 'accident enabler'?

Failure of the bulk nitrogen system to function can contribute to the events leading to an accident, either as the initiating event [Question 3] or as one of a series of events that causes the accident [an 'enabler']. The bulk nitrogen system is dependant on the following DWPF support systems: nitrogen storage tank. Failure of the nitrogen storage tank system causes failure of the bulk nitrogen system. There are two defined outcomes as follows:

- BlkN2En: The bulk N₂ system fails but does not initiate the accident.
- nBlkN2En: The bulk N₂ system continues to function [or its failure to function has previously been identified in Question 3 as the failure that initiates the accident].

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 159, 165, 168, 173, and 176. The parameter is as follows:

- Arg [94] FailBlkN2, a logical variable that indicates the state of the bulk N₂ system. The parameter is assigned a value of {-1.0} if the loss of function of the bulk N₂ system is the 'initiator', {+1.0} if the bulk N₂ system is not functioning but is not the 'initiator', and {0.0} if the bulk N₂ system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Question 32 and to determine the value assigned the above parameter. Five cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and failure of the bulk N₂ system is the initiating event [Question 3]. The outcome probability assigned is 1.0 for Branch 2. The parameter, FailBlkN2, is assigned a value of {-1.0} when Branch 2 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the N₂ storage tank

system has failed as initiator or enabler. The bulk N2 system cannot function without a supply of nitrogen. The outcome probability for Branch 1 is assigned to be 1.0. The parameter, FailBlkN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.

- Case 3 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the bulk N2 system did not fail as the initiator. The outcome probability for Branch 1 is calculated as a function of BlkN2Lmda and BlkN2Tau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailBlkN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of BlkN2Lmda and BlkN2Tau, BlkN2Fr, and BlkN2Rn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailBlkN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 5 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the bulk N2 system is not an accident 'enabler'. The parameter, FailBlkN2, is assigned a value of {0.0} when branch 2 is selected.

Question 30: Is the failure of the CPC backup liquid N2 Storage Tank System an 'accident enabler'?

Failure of the CPC backup N2 storage tank system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The backup liquid nitrogen storage tank system is not dependant on any other DWPF support systems. There are two defined outcomes as follows:

CPCTkEn: The CPC backup N2 storage tank system fails.

nCPCTkEn: The CPC backup N2 storage tank system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 59, 63, 67, 73, 77, 87, 89, 91, and 93. The parameter is as follows:

Arg [108] FailCPCTk, a logical variable that indicates the state of the CPC backup N2 storage tank system. The parameter is assigned a value of {+1.0} if the CPC backup N2 storage tank system is not functioning and {0.0} if the CPC backup N2 storage tank system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the outcome probabilities in Question 31 and

to determine the value assigned the above parameter. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2]. The outcome probability for Branch 1 is calculated as a function of CPCTkLmda and CPCTkTau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailCPCTk, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of CPCTkLmda and CPCTkTau, CPCTkFr, and CPCTkRn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailCPCTk, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 3 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the CPC backup N₂ storage tank system is not an accident 'enabler'. The parameter, FailCPCTk, is assigned a value of {0.0} when branch 2 is selected.

Question 31: Is failure of the CPC Nitrogen System an 'accident enabler'?

Failure of the CPC N₂ backup purge system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The CPC nitrogen backup purge system is dependant on the following DWPF support systems: the CPC backup liquid nitrogen storage tank and bulk liquid nitrogen storage tank. Failure of both of the nitrogen storage tank systems causes failure of the CPC nitrogen backup purge system. There are two defined outcomes as follows:

CPCN2En: The CPC N₂ backup purge system fails.

nCPCN2En: The CPC N₂ backup purge system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 59, 63, 67, 73, 77, 87, 89, 91, and 93. The parameter is as follows:

Arg [95] FailCPCN2, a logical variable that indicates the state of the CPC N₂ backup purge system. The parameter is assigned a value of {+1.0} if the CPC N₂ backup purge system is not functioning and {0.0} if the CPC N₂ backup purge system is functioning.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used in the logic to determine the value assigned the above parameter. Four cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the CPC N₂ storage tank system and the bulk nitrogen storage tank system have failed. The CPC N₂ backup purge system cannot function without a supply of nitrogen. The outcome probability for Branch 1 is assigned to be 1.0. The parameter, FailCPCN₂, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the CPC primary air purge system has failed. The outcome probability for Branch 1 is calculated as a function of CPCN₂Lmda and CPCN₂Tau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailCPCN₂, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 3 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of CPCN₂Lmda and CPCN₂Tau, CPCN₂Fr, and CPCN₂Rn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailCPCN₂, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the CPC N₂ backup purge system is not an accident 'enabler'. The parameter, FailCPCN₂, is assigned a value of {0.0} when branch 2 is selected.

Question 32: Is failure of the LPPP Backup Nitrogen System an 'accident enabler'?

Failure of the LPPP backup nitrogen purge system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The LPPP backup nitrogen system is not dependant on any other DWPF support systems. There are two defined outcomes as follows:

PPN2En: The LPPP backup nitrogen purge system fails.

nPPN2En: The LPPP backup nitrogen purge system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 165 and 173. The parameter is as follows:

Arg [113] FailPPN₂, a logical variable that indicates the state of the LPPP backup nitrogen purge system. The parameter is assigned a value of {+1.0} if the LPPP backup nitrogen purge system is failed and {0.0} if the LPPP backup nitrogen purge system is available.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Three cases are used to develop the outcome probabilities on the basis of prior events as follow.

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the bulk nitrogen system fails either as an initiator or an enabler. The outcome probability for Branch 1 is calculated as a function of PPN2Lmda and PPN2Tau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailPPN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of PPN2Lmda and PPN2Tau, PPN2Fr, and PPN2Rn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailPPN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 3 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the LPPP backup nitrogen purge system is not an accident 'enabler'. The parameter, FailPPN2, is assigned a value of {0.0} when branch 2 is selected.

Question 33: Is failure of the SPC N2 System an 'accident enabler'?

Failure of the SPC N2 purge system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The SPC nitrogen system is dependant on the following DWPF support systems: bulk nitrogen storage system. Failure of the bulk nitrogen storage system causes failure of the SPC N2 purge system. There are two defined outcomes as follows:

- SPCN2En: The SPC N2 purge system fails.
- nSPCN2En: The SPC N2 purge system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 42, 46, 50, 54, 79, 81, 83, and 85. The parameter is as follows:

- Arg [118] FailSPCN2, a logical variable that indicates the state of the SPC N2 purge system. The parameter is assigned a value of {+1.0} if the SPC N2 purge system is failed and {0.0} if the SPC N2 purge system is available.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Four cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2] and the N2 storage tank system has failed. The SPC N2 purge system cannot function without a supply of nitrogen. The outcome probability for Branch 1 is assigned to be 1.0. The parameter, FailSPCN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 2 This case includes those sequences in which the accident class is an internal-energetic event [Question 1, Branch 2]. The outcome probability for Branch 1 is calculated as a function of SPCN2Lmda and SPCN2Tau. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailSPCN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 3 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of SPCN2Lmda and SPCN2Tau, SPCN2Fr, and SPCN2Rn and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailSPCN2, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the SPC N2 purge system is not an accident 'enabler'. The parameter, FailSPCN2, is assigned a value of {0.0} when branch 2 is selected.

Question 34: Is the failure of the SPC Seismic trigger System an 'accident enabler'?

Failure of the SPC seismic trigger system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The SPC seismic trigger is not dependant on any other DWPF support systems. There are two defined outcomes as follows:

STrigEn: The SPC seismic trigger system fails.

nSTrigEn: The SPC seismic trigger system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 42, 46, 50, 54, 77, 79, 81, 83, and 85. The parameter is as follows:

Arg [135] FailTrig, a logical variable that indicates the state of the SPC seismic trigger system. The parameter is assigned a value of {+1.0} if the SPC seismic trigger system is failed and {0.0} if the SPC seismic trigger system is available.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of TrigLmda and TrigTau, TrigFr, and Zero and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailTrig, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the SPC seismic trigger system is not an accident 'enabler'. The parameter, FailTrig, is assigned a value of {0.0} when branch 2 is selected.

Question 35: Is the failure of the SPC Isolation valve UPS an 'accident enabler'?

Failure of the SPC Isolation valve UPS system to function can contribute to the events leading to an accident as one of a series of events that causes the accident [an 'enabler']. The SPC isolation valve UPS system is not dependant on any other DWPF support systems. There are two defined outcomes as follows:

- SUPSEn: The SPC Isolation valve UPS system fails.
- nSUPSEn: The SPC Isolation valve UPS system continues to function.

This is a Type 8 question and defines a parameter that is used in determining outcome probabilities of later Questions 42, 46, 50, 54, 77, 79, 81, 83, and 85. The parameter is as follows:

- Arg [136] FailUPS, a logical variable that indicates the state of the SPC Isolation valve UPS system. The parameter is assigned a value of {+1.0} if the SPC Isolation valve UPS system is failed and {0.0} if the SPC Isolation valve UPS system is available.

The outcome probabilities for this question depend on the accident class and the reliability of the system and are used to determine the value assigned the above parameter. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the accident class is an external event [Question 1, Branch 1]. The outcome probability for Branch 1 is calculated as a function of SUPSLmda and SUPSTau, SPCUPSEn, and Zero and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailUPS, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, failure of the SPC Isolation valve UPS system is not an accident 'enabler'. The parameter, FailUPS, is assigned a value of {0,0} when branch 2 is selected.

Question 36: Is there a randomly initiated explosion in a process tank or cell?

As discussed above, the common system events are handled in Questions 8-35. Each of the fault trees developed may include hundreds of other independent events that can cause failure in addition to the common system events. Therefore, it is necessary to treat properly the portions of the accident fault trees which do not involve common system events as initiating events and in fact may be completely independent of the state of the common systems. That is the purpose of this question. There are sixteen possible outcomes to this question as follows:

- nRndExp: There has been no random explosion.
- Ex-SRAT: A random explosion [i.e., not caused by failure of a common system] has occurred in the Sludge Receipt and Adjustment Tank [SRAT].
- Ex-SME: A random explosion has occurred in the Slurry Mix Evaporator [SME].
- Ex-PVVH: A random explosion has occurred in the Process Vessel Vent Header [PVVH].
- Ex-PRBT: A random explosion has occurred in the Precipitate Reactor Bottoms Tank [PRBT].
- Ex-MFT: A random explosion has occurred in the Melter Feed Tank [MFT].
- Ex-OWST: A random explosion has occurred in the Organic Waste Storage Tank [OWST].
- Ex-PR: A random explosion has occurred in the Precipitate Reactor [PR].
- Ex-MOG: A random explosion has occurred in the Melter Offgas System [MOG].
- Ex-OEV A random explosion has occurred in the Organic Evaporator [OEV].
- Ex-OECT A random explosion has occurred in the Organic Evaporator Condensate Tank [OECT].
- Ex-PRFT A random explosion has occurred in the Precipitate Reactor Feed Tank [PRFT].
- Ex-PPST A random explosion has occurred in the Low Point Pump Pit Sludge Tank [PPST].
- Ex-PPPT A random explosion has occurred in the Low Point Pump Pit Precipitate Tank [PPPT].

Ex-SMEL A random steam explosion has occurred in the Melter.

Ex-SPC A random explosion due to overpressurization has occurred in the Salt Process Cell [SPC].

This is a Type 4 question and defines parameters used in calculations to determine the outcome probabilities in later Questions 42, 46, 50, 54, 59, 63, 67, 73, 77, 79, 81, 83, 85, 87, 89, 92, 93, 114, 152, 154, 159, 165, 168, 173, and 176. The parameters are as follows:

Arg [70]: MissTime, the repair time of the affected system. Note: this parameter is a place holder and is not used in the Mode C analysis.

Arg [71]: nCommI, a parameter whose value indicates whether or not a random explosion [i.e., not caused by failure of a common system] has occurred. If the value of the parameter is 0.0 a random explosion has not occurred. If the value of the parameter is > 1.0 then a random explosion has occurred, the value of the parameter defines the location of the explosion.

The answer to this question, and the values assigned the parameters, depends upon the outcome of previous Questions 1 and 3. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the accident class is an internal initiating event and failure of a common system is not an initiating event. The outcome probability assigned to Branch 1 is 0.0, i.e., no explosion was caused by failure of a common system. Each of the remaining branches are assigned the same outcome probability of 1/15. Although the outcome probabilities assigned are arbitrary the frequency of random explosions in the various tanks and systems will be renormalized to eliminate the arbitrary nature of these assigned probabilities. The UFUN performs this re-normalization by multiplying the calculated results by 15 during a UFUN call that came when the APET was on one of the branches of this question other than branch 1.

The parameters MissTime and nCommI are assigned values of 0.0 for Branch 1. When Branches 2 through 16 are selected the parameter MissTime is assigned a value of 0.0; the parameter nCommI is assigned a value of the branch number minus 1.0.

Case 2 The default case includes all other sequences and assumes that failure of a common system is designated as the initiating event or that the initiating event is a seismic event. The outcome probability assigned is 1.0 in Branch 1. The parameter MissTime is assigned values of 0.0, and the parameter nCommI is assigned dummy values that are the same as the values assigned in Case 1 except for branch 1 which is assigned the value of -10. The -10 value is a control parameter used to tell the UFUN how to calculate the seismic accident probabilities.

Question 37: Do the cell covers over the Salt Process Cell dislodge and fall because of a seismic event?

The process cells within the main canyon of the DWPF are 'roofed' by removable steel covers. These covers provide limited isolation of the cell in the event of an in-cell release, assist in maintaining proper ventilation flow, and protect the equipment within the cell from falling objects. However, if the cell covers are dislodged and fall into the cell, either through a seismic event or an energetic event within the cell, they may damage the equipment in the cell. This question examines the impact of a seismic event on the covers for the Salt Process Cell. There are two possible outcomes as follows:

fSCvSeis: The Salt Cell Covers are dislodged by the Seismic event and falls on the equipment [tanks, piping, etc.] in the cell.

nfSCvSei: The Salt Cell Covers remain in place following the Seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2 and the value specified for the parameter CCovFr, the seismic fragility of the covers for the Salt and Chemical Process Cells. The answers to this question are used in the logic to determine the outcome probabilities in Questions 40, 41, 44, 45, 48, 49, 52, 53, 75, 95, 105, 127 and 128.

Two cases are used to develop the outcome probabilities on the basis of prior events:

Case 1 This case includes those sequences in which the initiating event is a seismic event. The seismic fragility of the covers for the Salt and Chemical Process Cells [the probability the cell covers will fall] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 38: Does a cell cover fall while being moved by the crane?

Another possible way to drop a cell cover into a cell is for it to fall while suspended from an overhead crane. The process cell covers may be dropped during maintenance operations while being moved using the overhead crane. Crane load drops are a documented occurrence at SRS (Reference 6) and therefore are to be considered in the DWPF. Again, the falling covers may strike a tank causing it to be ruptured and spilling the contents into the cell. There are two defined outcomes as follows:

CDCvSPC: A cell cover is dropped by the overhead crane into a cell.

nCDCvSPC: A cell cover is not dropped by the overhead crane a cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 6 and are used in the logic to determine the outcome of Question 39. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 1, Branch 5 [accident class - Ltd-CD] and Question 6, Branch 2 [Crane Drop]. An outcome probability of 1.0 is assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 39: Do the cell covers that fall in a crane accident strike a tank?

There are fourteen defined outcomes for a crane load drop:

No_Hit: A cell cover is dropped by the overhead crane but does not strike any process tank.

CD_Prx: A cell cover is dropped by the overhead crane into the Salt Process Cell and strikes the PR.

CD_Oev: A cell cover is dropped by the overhead crane into the Salt Process Cell and strikes the OEV.

CD_OECT: A cell cover is dropped by the overhead crane into the Salt Process Cell and strikes the OECT.

CD_PRFT: A cell cover is dropped by the overhead crane into the Salt Process Cell and strikes the PRFT.

CD_PRBT: A cell cover is dropped by the overhead crane into the Chemical Process Cell and strikes the PRBT.

CD_SME: A cell cover is dropped by the overhead crane into the Chemical Process Cell and strikes the SME.

CD_SRAT: A cell cover is dropped by the overhead crane into the Chemical Process Cell and strikes the SRAT.

CD_RCT: A cell cover is dropped by the overhead crane into the Chemical Process Cell and strikes the RCT.

CD_MFT: A cell cover is dropped by the overhead crane into the Chemical Process Cell and strikes the MFT.

CD_MEL: A cell cover is dropped by the overhead crane into the Melter Cell and strikes the Melter.

CD_PPPT: A cell cover is dropped by the overhead crane into the Low Point Pump Pit Precipitate Cell and strikes the PPPT.

CD_PPST: A cell cover is dropped by the overhead crane into the Low Point Pump Pit Sludge Cell and strikes the PPST.

CD_PPRT: A cell cover is dropped by the overhead crane into the Low Point Pump Pit Recycle Cell and strikes the PPRT.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Question 38 and are used in the logic to determine the outcome of Questions 41, 45, 49, 53, 58, 62, 66, 70, 72, 157, 171, 179, and 181. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 38, Branch 1 [a cell cover has been dropped by a crane]. The selection of the outcome probabilities for each branch are based on the number of cell covers available in the facility that may be dropped and the probability of striking and damaging a individual tank. The calculational details are discussed in Reference 7. Branch 1 is assigned a probability of 1.0 minus the sum of the other branch probabilities.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 1.

Question 40: Do the cell covers that fall in a seismic event strike the PR?

Falling cell covers during a seismic event can rupture and spill the contents of the Precipitate Reactor. There are two possible outcomes as follows:

SCv-PR: The Salt Cell Covers are dislodged by the Seismic event and fall on the Precipitate Reactor.

nSCv-PR: The Salt Cell Covers are dislodged by the Seismic event and do not fall on the Precipitate Reactor.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 37. The answers to this question are used in the logic to determine the outcome probabilities in Question 41. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the initiating event is a seismic event and the Salt Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 41: Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor in the Salt Process Cell?

Falling cell covers during a seismic event or from a crane drop accident can rupture and spill the contents of the Precipitate Reactor. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

Rpt-PRx: The Precipitate Reactor is ruptured and the contents spilled as a result of a seismic event or a crane drop accident.

nRpt-PRx: The Precipitate Reactor is intact following a seismic event or crane drop accident.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Questions 2, 37, 39, and 40 and the value specified for the parameter PRx-Fr, the seismic fragility of the Precipitate Reactor. The answers to this question are used in the logic to determine the outcome probabilities in Questions 43, 80, 106, 123, and 136. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Salt Process Cell to fall and strike the PR. The falling cell covers are assumed to rupture and spill the contents of the Precipitate Reactor, i.e., an outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or the cell covers fall but do not strike the PR. The seismic fragility of the Precipitate Reactor [the probability that a seismic event will cause a structural failure of the Precipitate Reactor] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2 and the Precipitate Reactor is undamaged.

Questions 42 to 78 contain the first round of explosion questions for tanks in the SPC and the CPC. The questions consider the possibility of an explosive concentration being present in a tank along with the probability of an ignition source being present. Reference 5 is the common source for the fault tree calculations to determine the frequency of explosions.

Question 42: Does an explosive concentration accumulate in Precipitate Reactor?

A fault tree was constructed to calculate the frequency of explosions in the PR for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Precipitate Reactor. The two outcomes defined for this question are as follows:

Con-PRx: An explosive concentration accumulates in the Precipitate Reactor.

nCon-PRx: . An explosive concentration does not accumulate in the Precipitate Reactor.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Precipitate Reactor. The user function includes information from solution of the fault tree for the Precipitate Reactor Explosion. The function used to calculate the answer depends on the answer to previous Question 1 (i.e., different fault trees are used for internal-energetic events and seismic events). The answers to this question are used in the logic to determine the outcome probabilities in Question 43.

The case structure is simplified by not considering the possibility of prior rupture of the Precipitate Reactor [Question 41] which is assumed to prevent the buildup of an explosive concentration in the Precipitate Reactor. The possibility of prior rupture of the Precipitate Reactor is included in Question 43. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PR and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PRS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 43: Does a damaging deflagration/detonation occur in the Precipitate Reactor?

If an explosive concentration occurs in the Precipitate Reactor and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the Precipitate Reactor Explosion includes the probability of an ignition source. Therefore, if Question 42 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation/deflagration in the Precipitate Reactor can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

PRx-Det: A damaging detonation occurs in the Precipitate Reactor.

PRx-Def: A damaging deflagration occurs in the Precipitate Reactor.

nPRx-Exp: No damaging explosion occurs in the Precipitate Reactor.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 41 and 42. The answers to this question are used in the logic to determine the outcome probabilities in Questions 75, 78, 80, 105, 106, 107, and 123. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the Precipitate Reactor precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Precipitate Reactor and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 44: Do the cell covers that fall in a seismic event strike the OEV?

Falling cell covers during a seismic event can rupture and spill the contents of the Organic Evaporator. There are two possible outcomes as follows:

- SCv-OEV: The Salt Cell Covers are dislodged by the Seismic event and fall on the Organic Evaporator.
- nSCv-OEV: The Salt Cell Covers are dislodged by the Seismic event and do not fall on the Organic Evaporator.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 37. The answers to this question are used in the logic to determine the outcome probabilities in Question 45. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Salt Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.

- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 45: Does a Seismic event or cover crane fall rupture and spill the contents of the Organic Evaporator in the Salt Process Cell?

Falling cell covers during a seismic event or from a crane drop accident can rupture and spill the contents of the Organic Evaporator. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

- Rpt-OEV: The Organic Evaporator is ruptured and the contents spilled as a result of a seismic event or a crane drop accident.
- nRpt-OEV: The Organic Evaporator is intact following a seismic event or crane drop accident.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Questions 2, 37, 39, and 44 and the value specified for the parameter OEV-Fr, the seismic fragility of the Organic Evaporator. The answers to this question are used in the logic to determine the outcome probabilities in Questions 47, 82, 107, 124, and 137. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Salt Process Cell to fall and strike the OEV. The falling cell covers are assumed to rupture and spill the contents of the Organic Evaporator, i.e., an outcome probability of 1.0 is assigned Branch 1.
- Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or the cell covers fall but do not strike the OEV. The seismic fragility of the Organic Evaporator [the probability that a seismic event will cause a structural failure of the Organic Evaporator] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2 and the Organic Evaporator is undamaged.

Question 46: Does an explosive concentration accumulate in the Organic Evaporator Tank?

A fault tree was constructed to calculate the frequency of explosions in the OEV for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Organic Evaporator. The two outcomes defined for this question are as follows:

- Con-OEV: An explosive concentration accumulates in the Organic Evaporator.

nCon-OEV: -- An explosive concentration does not accumulate in the Organic Evaporator.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Organic Evaporator. The user function includes information from solution of the fault tree for the Organic Evaporator Explosion. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Question 47.

The case structure is simplified by not considering the possibility of prior rupture of the Organic Evaporator [Question 45] which is assumed to prevent the buildup of an explosive concentration in the Organic Evaporator. The possibility of prior rupture of the Organic Evaporator is included in Question 47. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-OEV and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-OEVs and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 47: Does a detonation/deflagration of the Organic Evaporator tank occur?

If an explosive concentration occurs in the Organic Evaporator and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the Organic Evaporator Explosion includes the probability of an ignition source. Therefore, if Question 46 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation/deflagration in the Organic Evaporator can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

OEV-Det: A damaging detonation occurs in the Organic Evaporator.

DEV-Def: A damaging deflagration occurs in the Organic Evaporator.

nOEV-Exp: No damaging explosion occurs in the Organic Evaporator.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 45 and 46. The answers to this question are used in the logic to determine the outcome probabilities in Questions 75, 78, 82, 105, 106, 107, 108, and 124. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the Organic Evaporator precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Organic Evaporator and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 48: Do the cell covers that fall in a seismic event strike the OECT?

Falling cell covers during a seismic event can rupture and spill the contents of the Organic Evaporator Condensate Tank. There are two possible outcomes as follows:

- SCv-OECT: The Salt Cell Covers are dislodged by the Seismic event and fall on the Organic Evaporator Condensate Tank.
- nSCv-OECT: The Salt Cell Covers are dislodged by the Seismic event and do not fall on the Organic Evaporator Condensate Tank.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 37. The answers to this question are used in the logic to determine the outcome probabilities in Question 49. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Salt Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 49: Does a Seismic event or cover crane fall rupture and spill the contents of the Organic Evaporator Condensate Tank in the Salt Process Cell?

Falling cell covers during a seismic event or from a crane drop accident can rupture and spill the contents of the Organic Evaporator Condensate Tank. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

RptOECT: The Organic Evaporator Condensate Tank is ruptured and the contents spilled as a result of a seismic event or a crane drop accident.

nRptOECT: The Organic Evaporator Condensate Tank is intact following a seismic event or crane drop accident.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Questions 2, 37, 39, and 48 and the value specified for the parameter OECTFr, the seismic fragility of the Organic Evaporator Condensate Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 51, 84, 108, 125, and 138. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Salt Process Cell to fall and strike the OECT. The falling cell covers are assumed to rupture and spill the contents of the Organic Evaporator Condensate Tank, i.e., an outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or the cell covers fall but do not strike the OECT. The seismic fragility of the Organic Evaporator Condensate Tank [the probability that a seismic event will cause a structural failure of the Organic Evaporator Condensate Tank] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2 and the Organic Evaporator Condensate Tank is undamaged.

Question 50: Does an explosive concentration accumulate in Organic Evaporator Condensate Tank?

A fault tree was constructed to calculate the frequency of explosions in the OECT for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Organic Evaporator Condensate Tank. The two outcomes defined for this question are as follows:

Con-OECT: An explosive concentration accumulates in the Organic Evaporator Condensate Tank.

nCon-OECT: An explosive concentration does not accumulate in the Organic Evaporator Condensate Tank.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Organic Evaporator Condensate Tank. The user function includes information from solution of the fault tree for the Organic Evaporator Condensate Tank Explosion. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Question 51.

The case structure is simplified by not considering the possibility of prior rupture of the Organic Evaporator Condensate Tank [Question 49] which is assumed to prevent the buildup of an explosive concentration in the Organic Evaporator Condensate Tank. The possibility of prior rupture of the Organic Evaporator Condensate Tank is included in Question 51. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-OECT and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-OECTS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 51: Does a detonation/deflagration of the Organic Evaporator Condensate tank occur?

If an explosive concentration occurs in the Organic Evaporator Condensate Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the Organic Evaporator Condensate Tank Explosion includes the probability of an ignition source. Therefore, if Question 50 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation/deflagration in the Organic Evaporator Condensate Tank can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- OECT-Det: A damaging detonation occurs in the Organic Evaporator Condensate Tank.
- OECT-Def: A damaging deflagration occurs in the Organic Evaporator Condensate Tank.
- nOECT-Exp: No damaging explosion occurs in the Organic Evaporator Condensate Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 49 and 50. The answers to this question are used in the logic to determine the outcome probabilities in Questions 75, 78, 84, 105, 107, 108, 109, and 125. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the Organic Evaporator Condensate Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the Organic Evaporator Condensate Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Organic Evaporator Condensate Tank and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4. The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 52: Do the cell covers that fall in a seismic event or crane accident strike the PRFT?

Falling cell covers during a seismic event can rupture and spill the contents of the Precipitate Reactor Feed Tank. There are two possible outcomes as follows:

- SCv-PRFT: The Salt Cell Covers are dislodged by the Seismic event and fall on the Precipitate Reactor Feed Tank.
- nSCv-PRFT: The Salt Cell Covers are dislodged by the Seismic event and do not fall on the Precipitate Reactor Feed Tank.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 37. The answers to this question are used in the logic to determine the outcome probabilities in Question 53.

Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Salt Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 53: Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor Feed Tank in the Salt Process Cell?

Falling cell covers during a seismic event or from a crane drop accident can rupture and spill the contents of the Precipitate Reactor Feed Tank. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

- RptPRFT: The Precipitate Reactor Feed Tank is ruptured and the contents spilled as a result of a seismic event or a crane drop accident.
- nRptPRFT: The Precipitate Reactor Feed Tank is intact following a seismic event or crane drop accident.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Questions 2, 37, 39, and 52 and the value specified for the parameter PRFTFr, the seismic fragility of the Precipitate Reactor Feed Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 55, 86, 109, 126, and 139. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Salt Process Cell to fall and strike the PRFT. The falling cell covers are assumed to rupture and spill the contents of the Precipitate Reactor Feed Tank, i.e., an outcome probability of 1.0 is assigned Branch 1.
- Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or the cell covers fall but do not strike the PRFT. The seismic fragility of the Precipitate Reactor Feed Tank [the probability that a seismic event will cause a structural failure of the Precipitate Reactor Feed Tank] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2 and the Precipitate Reactor Feed Tank is undamaged.

Question 54: Does an explosive concentration accumulate in Precipitate Reactor Feed Tank?

A fault tree was constructed to calculate the frequency of explosions in the PRFT for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Precipitate Reactor Feed Tank. The two outcomes defined for this question are as follows:

Con-PRFT: An explosive concentration accumulates in the Precipitate Reactor Feed Tank.

nCon-PRFT: An explosive concentration does not accumulate in the Precipitate Reactor Feed Tank.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Precipitate Reactor Feed Tank. The user function includes information from solution of the fault tree for the Precipitate Reactor Feed Tank Explosion. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Question 55.

The case structure is simplified by not considering the possibility of prior rupture of the Precipitate Reactor Feed [Question 53] which is assumed to prevent the buildup of an explosive concentration in the Precipitate Reactor Feed Tank. The possibility of prior rupture of the Precipitate Reactor Feed Tank is included in Question 55. Four cases are used to develop the outcome probabilities as follows:

Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.

Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PRFT and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1

Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PRFTS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1

Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 55: Does a detonation/deflagration occur in the Precipitate Reactor Feed tank?

If an explosive concentration occurs in the Precipitate Reactor Feed Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the Precipitate Reactor Feed Tank Explosion includes the probability of an ignition source. Therefore, if Question 54 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation/deflagration in the Precipitate Reactor Feed Tank can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- PRFT-Det: A damaging detonation occurs in the Precipitate Reactor Feed Tank.
- PRFT-Def: A damaging deflagration occurs in the Precipitate Reactor Feed Tank.
- nPRFT-Exp: No damaging explosion occurs in the Precipitate Reactor Feed Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 53 and 54. The answers to this question are used in the logic to determine the outcome probabilities in Questions 75, 78, 86, 97, 105, 108, 109, and 126. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the Precipitate Reactor Feed Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Precipitate Reactor Feed Tank and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. **SAMPLED VARIABLE**
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 56: Do the cell covers for the Chemical Process Cell dislodge and fall following a seismic event?

The process cells within the main canyon of the DWPF are 'roofed' by removable steel covers. These covers provide limited isolation of the cell in the event of an in-cell release, assist in maintaining proper ventilation flow, and protect the equipment within the cell from falling objects. However, if the cell covers are dislodged and fall into the cell, either through a seismic event or an energetic event within the cell, they may damage the equipment in the cell.

This question examines the impact of a seismic event on the covers for the Chemical Process Cell. There are two possible outcomes as follows:

- fCCvSeis: The Chemical Cell Covers are dislodged by the Seismic event and fall on the equipment [tanks, piping, etc.] in the cell.
- nfCCvSei: The Chemical Cell Covers remain in place following the Seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2 and the value specified for the parameter CCovFr, the seismic fragility of the covers for the Salt and Chemical Process Cells. The answers to this question are used in the logic to determine the outcome probabilities in Questions 57, 58, 61, 62, 65, 66, 69, 70, 71, 72, 76, 78, 96, 98, 129, and 141. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event. The seismic fragility of the covers for the Salt and Chemical Process Cells [the probability the cell covers will fall] is placed in Branch 1. The outcome probability for Branch 2, is 1.0 less the probability assigned Branch 1.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 57: Do the cell covers that fall in a seismic event strike the PRBT?

Falling cell covers during a seismic event can rupture and spill the contents of the Precipitate Reactor Bottoms Tank. There are two possible outcomes as follows:

- CCv-PRBT: The Chemical Cell Covers are dislodged by the Seismic event and fall on the Precipitate Reactor Bottoms Tank.
- nCCv-PRBT: The Chemical Cell Covers are dislodged by the Seismic event and do not fall on the Precipitate Reactor Bottoms Tank.

This is a Type 2 condition. The answer to this question depends upon the outcome of previous Questions 2 and . The answers to this question are used in the logic to determine the outcome probabilities in Question 58. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Chemical Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
SAMPLED VARIABLE.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 58: Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor Bottoms Tank in the Chemical Process Cell?

Falling cell covers during a seismic event or a crane load drop can rupture and spill the contents of the Precipitate Reactor Bottoms Tank [PRBT]. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

RptPRBT: The Precipitate Reactor Bottoms Tank is ruptured and the contents spilled as a result of the seismic event or a crane drop accident.

nRptPRBT: The Precipitate Reactor Bottoms Tank is intact.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 39, 56, and 57 and the value specified for the parameter PRBTFr, the seismic fragility of the Precipitate Reactor Bottoms Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 60, 88, 99, 130, and 142. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Chemical Process Cell to fall and strike the PRBT. The falling cell covers are assumed to rupture and spill the contents of the PRBT, i.e., an outcome probability of 1.0 is assigned Branch 1, RptPRBT.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall. The seismic fragility of the PRBT [the probability that a seismic event will cause a structural failure of the PRBT] is placed in Branch 1. The outcome probability for Branch 2, nRptPRBT, is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the PRBT is undamaged.

Question 59: Does an explosive concentration accumulate in the Precipitate Reactor Bottoms Tank [PRBT]?

A fault tree was constructed to calculate the frequency of explosions in the PRBT for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Precipitate Reactor Bottoms Tank. The two outcomes defined for this question are as follows:

ConPRBT: An explosive concentration accumulates in the PRBT.

nConPRBT: An explosive concentration does not accumulate in the PRBT.

This is a Type 6 question and uses previously quantified parameters [60, 66, 67, 70, 71, 90, 95, and 108] and a user defined function to determine the probability that an explosive

concentration will occur in the PRBT. The user function includes information from solution of the fault tree for the PRBT explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 60.

The following case structure is simplified by not considering the possibility of prior rupture of the PRBT [Question 58]. Rupture of the PRBT would prevent the buildup of an explosive concentration in the PRBT. The possibility of prior rupture of the PRBT is included in Question 60. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case is used to exclude those sequences where the bulk N₂ tank fails as an initiator. The bulk N₂ tank supplies nitrogen to the CPC backup nitrogen system. Since the system is a backup, its failure cannot initiate accidents in the CPC. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PRBT and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PRBTs and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 60: Does a detonation/deflagration occur in the Precipitate Reactor Bottoms Tank [PRBT]?

If an explosive concentration occurs in the Precipitate Reactor Bottoms Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the explosion includes the probability of an ignition source. Therefore, if Question 59 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation or deflagration in the Precipitate Reactor Bottoms Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- PRBT-Det: A damaging detonation occurs in the Precipitate Reactor Bottoms Tank.
- PRBT-Def: A damaging deflagration occurs in the Precipitate Reactor Bottoms Tank.
- nPRBT-Ex: No damaging explosion occurs in the Precipitate Reactor Bottoms Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 58 and 59. The answers to this question are used in the logic to determine the outcome probabilities in Questions 76, 78, 88, 98, 99, 100, 104, and 130. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the PRBT. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the PRBT precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Precipitate Reactor Bottoms Tank and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 61: Do the cell covers that fall due to a seismic event strike the SME?

Falling cell covers during a seismic event can rupture and spill the contents of the Slurry Mix Evaporator. There are two possible outcomes as follows:

- CCv-SME: The Chemical Cell Covers are dislodged by the Seismic event and fall on the Slurry Mix Evaporator.
- nCCv-SME: The Chemical Cell Covers are dislodged by the Seismic event and do not fall on the Slurry Mix Evaporator.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 56. The answers to this question are used in the logic to determine the outcome probabilities in Question 62. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Chemical Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 62: Does a Seismic event or cover crane fall rupture and spill the contents of the Slurry Mix Evaporator Tank in the Chemical Process Cell?

Falling cell covers during a seismic event or a crane load drop can rupture and spill the contents of the Slurry Mix Evaporator. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

RptSME: The Slurry Mix Evaporator is ruptured and the contents spilled as a result of the seismic event or a crane drop accident.

nRptSME: The Slurry Mix Evaporator is intact.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 39, 56, and 61 and the value specified for the parameter SME-Fr, the seismic fragility of the Slurry Mix Evaporator. The answers to this question are used in the logic to determine the outcome probabilities in Questions 64, 90, 100, 131, and 143. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Chemical Process Cell to fall and strike the SME. The falling cell covers are assumed to rupture and spill the contents of the SME, i.e., an outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall. The seismic fragility of the SME [the probability that a seismic event will cause a structural failure of the SME] is placed in Branch 1. The outcome probability for Branch 2, nRptSME, is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the SME is undamaged.

Question 63: Does an explosive concentration accumulate in the Slurry Mix Evaporator Tank [SME]?

A fault tree was constructed to calculate the frequency of explosions in the SME for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Slurry Mix Evaporator. The two outcomes defined for this question are as follows:

ConSME: An explosive concentration accumulates in the SME.

nConSME: An explosive concentration does not accumulate in the SME.

This is a Type 6 question and uses previously quantified parameters [60, 61, 62, 64, 66, 67, 70, 71, 90, 93, 95, 98, 103, and 108] and a user defined function to determine the probability

that an explosive concentration will occur in the SME. The user function includes information from solution of the fault tree for the SME explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 64.

The following case structure is simplified by not considering the possibility of prior rupture of the SME [Question 62]. Rupture of the SME would prevent the buildup of an explosive concentration in the SME. The possibility of prior rupture of the SME is included in Question 64. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case is used to exclude those sequences where the bulk N₂ tank fails as an initiator. The bulk N₂ tank supplies nitrogen to the CPC backup nitrogen system. Since the system is a backup, its failure cannot initiate accidents in the CPC. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-SME and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-SMES and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 64: Does a detonation/deflagration occur in the Slurry Mix Evaporator Tank [SME]?

If an explosive concentration occurs in the Slurry Mix Evaporator and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the explosion includes the probability of an ignition source. Therefore, if Question 63 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation or deflagration in the Slurry Mix Evaporator can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- SME-Det: A damaging detonation occurs in the Slurry Mix Evaporator.
- SME-Def: A damaging deflagration occurs in the Slurry Mix Evaporator.
- nSME-Ex: No damaging explosion occurs in the Slurry Mix Evaporator.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 62 and 63. The answers to this question are used in the logic to determine the outcome probabilities in Questions 76, 78, 90, 98, 99, 100, and 131. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the SME. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the SME precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Slurry Mix Evaporator and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 65: Do the cell covers that fall in a seismic event strike the SRAT?

Falling cell covers during a seismic event can rupture and spill the contents of the Sludge Receipt Adjustment Tank. There are two possible outcomes as follows:

- CCv-SRAT: The Chemical Cell Covers are dislodged by the seismic event and fall on the Sludge Receipt Adjustment Tank.
- nCCv-SRAT: The Chemical Cell Covers are dislodged by the seismic event and do not fall on the Sludge Receipt Adjustment Tank.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 56. The answers to this question are used in the logic to determine the outcome probabilities in Question 66. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Chemical Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 66: Does a Seismic event or cover crane fall rupture and spill the contents of the Sludge Receipt And Adjustment Tank in the Chemical Process Cell?

Falling cell covers during a seismic event or a crane load drop can rupture and spill the contents of the Sludge Receipt Adjustment Tank. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

RptSRAT: The Sludge Receipt Adjustment Tank is ruptured and the contents spilled as a result of the seismic event or a crane drop accident.

nRptSRAT: The Sludge Receipt Adjustment Tank is intact.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 39, 56, and 65 and the value specified for the parameter SRATFr, the seismic fragility of the Sludge Receipt Adjustment Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 68, 92, 101, 132, and 144. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1** This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Chemical Process Cell to fall and strike the SRAT. The falling cell covers are assumed to rupture and spill the contents of the SRAT, i.e., an outcome probability of 1.0 is assigned Branch 1.
- Case 2** This case includes all sequences in which a seismic event has occurred but the cell covers do not fall. The seismic fragility of the SRAT [the probability that a seismic event will cause a structural failure of the SRAT] is placed in Branch 1. The outcome probability for Branch 2, nRptSRAT, is 1.0 less the probability assigned Branch 1.
- Case 3** The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the SRAT is undamaged.

Question 67: Does an explosive concentration accumulate in the Sludge Receipt And Adjustment Tank [SRAT]?

A fault tree was constructed to calculate the frequency of explosions in the SRAT for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Sludge Receipt Adjustment Tank. The two outcomes defined for this question are as follows:

ConSRAT: An explosive concentration accumulates in the SRAT.

nConSRAT: An explosive concentration does not accumulate in the SRAT.

This is a Type 6 question and uses previously quantified parameters [60, 61, 62, 63, 64, 66, 67, 70, 71, 90, 93, 95, 98, 103, and 108] and a user defined function to determine the

probability that an explosive concentration will occur in the SRAT. The user function includes information from solution of the fault tree for the SRAT explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 68.

The following case structure is simplified by not considering the possibility of prior rupture of the SRAT [Question 66]. Rupture of the SRAT would prevent the buildup of an explosive concentration in the SRAT. The possibility of prior rupture of the SRAT is included in Question 68. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case is used to exclude those sequences where the bulk N₂ tank fails as an initiator. The bulk N₂ tank supplies nitrogen to the CPC backup nitrogen system. Since the system is a backup, its failure cannot initiate accidents in the CPC. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-SRAT and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-SRATS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 68: Does a detonation/deflagration occur in the Sludge Receipt Adjustment Tank [SRAT]?

If an explosive concentration occurs in the Sludge Receipt Adjustment Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the explosion includes the probability of an ignition source. Therefore, if Question 67 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation or deflagration in the Sludge Receipt Adjustment Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- SRAT-Det: A damaging detonation occurs in the Sludge Receipt Adjustment Tank.
- SRAT-Def: A damaging deflagration occurs in the Sludge Receipt Adjustment Tank.
- nSRAT-Ex: No damaging explosion occurs in the Sludge Receipt Adjustment Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 66 and 67. The answers to this question are used in the logic to determine the outcome probabilities in Questions 76, 78, 92, 98, 101, 102, and 132. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the SRAT. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the SRAT precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Sludge Receipt Adjustment Tank and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 69: Do the cell covers that fall in a seismic event strike the RCT?

Falling cell covers during a seismic event can rupture and spill the contents of the Recycle Collection Tank. There are two possible outcomes as follows:

- CCv-RCT: The Chemical Cell Covers are dislodged by the seismic event and fall on the Recycle Collection Tank.
- nCCv-RCT: The Chemical Cell Covers are dislodged by the seismic event and do not fall on the Recycle Collection Tank.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 56. The answers to this question are used in the logic to determine the outcome probabilities in Question 70. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the Chemical Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.
- Case 2. The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 70: Does a Seismic event or cover crane fall rupture and spill the contents of the Recycle Collection Tank in the Chemical Process Cell?

Falling cell covers during a seismic event or a crane load drop can rupture and spill the contents of the Recycle Collection Tank. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

Rpt-RCT: The Recycle Collection Tank is ruptured and the contents spilled as a result of the seismic event or a crane drop accident.

nRpt-RCT: The Recycle Collection Tank is intact.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 39, 56, and 69 and the value specified for the parameter RCTFr, the seismic fragility of the Recycle Collection Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 102 and 145. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Chemical Process Cell to fall and strike the RCT. The falling cell covers are assumed to rupture and spill the contents of the RCT, i.e., an outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall. The seismic fragility of the RCT [the probability that a seismic event will cause a structural failure of the RCT] is placed in Branch 1. The outcome probability for Branch 2, nRptRCT, is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the RCT is undamaged.

Question 71: Do the cell covers that fall in a seismic event strike the MFT?

Falling cell covers during a seismic event can rupture and spill the contents of the Melter Feed Tank. There are two possible outcomes as follows:

CCv-MFT: The Chemical Cell Covers are dislodged by the seismic event and fall on the Melter Feed Tank.

nCCv-MFT: The Chemical Cell Covers are dislodged by the seismic event and do not fall on the Melter Feed Tank.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 56. The answers to this question are used in the logic to determine the outcome probabilities in Question 72.

Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the initiating event is a seismic event and the Chemical Process Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01 [7], the outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. ****SAMPLED VARIABLE****.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 72: Does a Seismic event or cover crane fall rupture and spill the contents of the Melter Feed Tank in the Chemical Process Cell?

Falling cell covers during a seismic event or a crane load drop can rupture and spill the contents of the Melter Feed Tank. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

Rpt-MFT: The Melter Feed Tank is ruptured and the contents spilled as a result of the seismic event or a crane drop accident.

nRpt-MFT: The Melter Feed Tank is intact.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 39, 56, and 71 and the value specified for the parameter MFTFr, the seismic fragility of the Melter Feed Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 74, 94, 103, 133, and 146. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event or crane drop accident has caused the cell covers over the Chemical Process Cell to fall and strike the MFT. The falling cell covers are assumed to rupture and spill the contents of the MFT, i.e., an outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall. The seismic fragility of the MFT [the probability that a seismic event will cause a structural failure of the MFT] is placed in Branch 1. The outcome probability for Branch 2, nRpt-MFT, is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the MFT is undamaged.

Question 73: Does an explosive concentration accumulate in the Melter Feed Tank [MFT]?

A fault tree was constructed to calculate the frequency of explosions in the MFT for all credible initiators. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the Melter Feed Tank. The two outcomes defined for this question are as follows:

ConMFT: An explosive concentration accumulates in the MFT.

nConMFT: An explosive concentration does not accumulate in the MFT.

This is a Type 6 question and uses previously quantified parameters [60, 66, 67, 70, 71, 90, and 108] and a user defined function to determine the probability that an explosive concentration will occur in the MFT. The user function includes information from solution of the fault tree for the MFT explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 74.

The following case structure is simplified by not considering the possibility of prior rupture of the MFT [Question 72]. Rupture of the MFT would prevent the buildup of an explosive concentration in the MFT. The possibility of prior rupture of the MFT is included in Question 74. Five cases are used to develop the outcome probabilities as follows:

- Case 1** This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2** This case is used to exclude those sequences where the bulk N₂ tank fails as an initiator. The bulk N₂ tank supplies nitrogen to the CPC backup nitrogen system. Since the system is a backup, its failure cannot initiate accidents in the CPC. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3** This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-MFT and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4** This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-MFTS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5** The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 74: Does a detonation/deflagration occur in the Melter Feed Tank [MFT]?

If an explosive concentration occurs in the Melter Feed Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. The fault tree for the explosion includes the probability of an ignition source. Therefore, if Question 73 indicates that an explosive concentration is available then a detonation/deflagration will follow. A detonation or deflagration in the Melter Feed Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- MFT-Det: A damaging detonation occurs in the Melter Feed Tank.
- MFT-Def: A damaging deflagration occurs in the Melter Feed Tank.
- nMFT-Ex: No damaging explosion occurs in the Melter Feed Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 72 and 73. The answers to this question are used in the logic to determine the outcome probabilities in Questions 76, 78, 94, 98, 102, 103, and 133. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the MFT. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes the sequences in which a prior event has ruptured the MFT precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes the sequences in which a prior event has not ruptured the Melter Feed Tank and an explosive concentration has accumulated in the vessel. The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 75: Does a damaging explosion occur in the Salt Process Cell Vent System [SPCV]?

Conditions in the Salt Process Cell Vent System [SPCV] are expected to be the same as the tanks exhausting into the header. Therefore an explosion in any of the SPC tanks will propagate into the header causing the header to also explode. Because of the size of the SPCV, it is expected to detonate (not deflagrate) which would produce shrapnel that could cause venting of cell tanks. There are two possible outcomes as follows:

- SPCV-Exp: A damaging explosion occurs in the Salt Process Cell Vent System.

nSPCV-Ex: A damaging explosion does not occur in the Salt Process Cell Vent System.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 37, 43, 47, 51, and 55. The answers to this question are used in the logic to determine the outcome probabilities in Questions 78 and 95. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the SPC cell covers have fallen due to a seismic event. If the cell covers fall, the SPCV piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 2 This case includes all sequences in which one of the SPC vessels has detonated. A detonation in any SPC vessel is assumed to cause the SPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which one of the SPC vessels has deflagrated. A deflagration in any SPC vessel is assumed to cause the SPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that there is no other mechanism for an explosion in the SPCV. An outcome probability of 1.0 is assigned Branch 2.

Question 76: Does a damaging explosion occur in the Chemical Process Cell Vent System [CPCV]?

Conditions in the Chemical Process Cell Vent System [CPCV] are expected to be the same as the tanks exhausting into the header. Therefore an explosion in any of the CPC tanks will propagate into the header causing the header to also explode. Because of the size of the CPCV, it is expected to detonate (not deflagrate) which would produce shrapnel that could cause venting of cell tanks. There are two possible outcomes as follows:

CPCV-Exp: A damaging explosion occurs in the Chemical Process Cell Vent System.

nCPCV-Ex: No damaging explosion occurs in the Chemical Process Cell Vent System.

This is a Type 2 question. The answer is dependent on the outcome of previous Question 56, 60, 64, 68, and 74. The answers to this question are used in the logic to determine the outcome probabilities in Questions 78 and 96. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the CPC cell covers have fallen due to a seismic event. If the cell covers fall, the CPCV piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.

- Case 2 This case includes all sequences in which one of the CPC vessels has detonated. A detonation in any CPC vessel is assumed to cause the CPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which one of the CPC vessels has deflagrated. A deflagration in any CPC vessel is assumed to cause the CPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that there is no other mechanism for an explosion in the CPCV. An outcome probability of 1.0 is assigned Branch 2.

Question 77: Does an explosive concentration accumulate in the Process Vessel Vent Header [PVVH]?

The Process Vessel Vent Header [PVVH] consists of all piping from the base load air inlet to the PVVH blowers, including inlet HEPA filter, flow control valve, PVVH filter, preheater, and blower suction dampers. Potential sources of explosive gases to the PVVH are benzene from the vessels in the Salt Process Cell and hydrogen and benzene from the process vessels in the Chemical Process Cell. There are two defined outcomes as follows:

- ConPVVH: An explosive concentration accumulates in the Process Vessel Vent Header.
- nConPVVH: An explosive concentration does not accumulate in the Process Vessel Vent Header.

This is a Type 6 question and uses previously quantified parameters [60, 61, 62, 63, 64, 66, 67, 68, 70, 71, 90, 93, 95, 98, 103, 108, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the PVVH. The user function includes information from solution of the fault tree for a PVVH explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 78. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case is used to exclude those sequences where the bulk N₂ tank fails as an initiator. The bulk N₂ tank supplies nitrogen to the CPC backup nitrogen system. Since the system is a backup, its failure cannot initiate accidents in the CPC. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PVVH and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

- Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PVVHS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 78: Does a damaging detonation occur in the Process Vessel Vent Header [PVVH]?

If an explosive concentration occurs in the Process Vessel Vent Header [PVVH] and an ignition source is available it is assumed that a damaging detonation will follow. The fault tree for the PVVH detonation includes the probability of an ignition source. Therefore, if Question 77 indicates that an explosive concentration is available then a detonation will follow. Also, conditions in the [PVVH] are expected to be the same as the tanks exhausting into the header. Therefore an explosion in any of the SPC or CPC tanks will propagate into the header causing the header to also explode. A detonation in the PVVH can cause cell covers in the Chemical Process Cell to fall. There are two defined outcomes:

- PVVH-Det: A damaging detonation occurs in the Process Vessel Vent Header.
- nPVVH-Ex: No damaging explosion occurs in the Process Vessel Vent Header.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 43, 47, 51, 55, 56, 60, 64, 68, 74, 75, 76, and 77. The answers to this question are used in the logic to determine the outcome probabilities in Questions 80, 82, 84, 86, 88, 90, 92, 94, and 98. Six cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the CPC cell covers have fallen due to a seismic event. If the cell covers fall, the PVVH piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 2 This case includes all sequences in which a damaging detonation or deflagration has occurred in the SPC. The outcome probability assigned is 1.0 in Branch 1. If there is an explosion in one of the process tanks the explosion is assumed to propagate to the PVVH.
- Case 3 This case includes all sequences in which a damaging detonation or deflagration has occurred in the CPC. The outcome probability assigned is 1.0 in Branch 1. If there is an explosion in one of the process tanks the explosion is assumed to propagate to the PVVH.
- Case 4 This case includes the sequences in which an explosive concentration has not accumulated in the PVVH. The outcome probability assigned is 1.0 in Branch 2, there is not a damaging explosion.

- Case 5 This case includes the sequences in which an explosive concentration has accumulated in the PVVH. The outcome probability assigned is 1.0 in Branch 1, there is a damaging explosion.
- Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 2, there is no explosion.

Question 78 is the last question in the first round of possible energetic events considered in the APET. Questions 79-96 consider the possibility that another vessel has an explosive concentration built up (but no ignition source) at the same time another vessel deflagrates or detonates. This begins the second round of explosion questions. Since the process vessels are all cross-connected via the cell ventilation systems (SPCV, CPCV, PVVH), the vessel that deflagrates or detonates provides an ignition source to any other vessel that has an explosive concentration.

Question 79: Does an explosive concentration accumulate in Precipitate Reactor?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the PR without the presence of an ignition source. The two outcomes defined for this question are as follows:

- Con-PRx2: An explosive concentration accumulates in the Precipitate Reactor.
- nCon-PRx: An explosive concentration does not accumulate in the Precipitate Reactor.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Precipitate Reactor. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 80 and 123.

The case structure is simplified by not considering the possibility of any prior events with the Precipitate Reactor which would prevent the buildup of an explosive concentration in the Precipitate Reactor. The possibility of prior events with the Precipitate Reactor is included in Question 80. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PRIII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PRSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 80: Does a deflagration/detonation occur in the Precipitate Reactor?

If an explosive concentration occurs in the Precipitate Reactor and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Precipitate Reactor can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- PRx@2Det: A damaging detonation occurs in the Precipitate Reactor following a detonation or deflagration in another process vessel that provides an ignition source.
- PRx@2Def: A damaging deflagration occurs in the Precipitate Reactor following a detonation or deflagration in another process vessel that provides an ignition source.
- nPRx-Exp: No damaging explosion occurs in the Precipitate Reactor.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 41, 43, 78, and 79. The answers to this question are used in the logic to determine the outcome probabilities in Questions 95, 105, 106, 107 and 123. Six cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 4 This case includes the sequences in which a prior event has ruptured the Precipitate Reactor precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

- Case 5 This case includes the sequences in which a prior event has not occurred in the Precipitate Reactor and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].
- Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 81: Does an explosive concentration accumulate in Organic Evaporator Tank?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the OEV without the presence of an ignition source. The two outcomes defined for this question are as follows:

- Con-OEV2: An explosive concentration accumulates in the Organic Evaporator.
- nCon-OEV: An explosive concentration does not accumulate in the Organic Evaporator.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Organic Evaporator. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 82 and 124.

The case structure is simplified by not considering the possibility of any prior events with the Organic Evaporator which would prevent the buildup of an explosive concentration in the Organic Evaporator. The possibility of prior events with the Organic Evaporator is included in Question 82. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-OEVIII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-OEVSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 82: Does a deflagration/detonation of the Organic Evaporator tank occur?

If an explosive concentration occurs in the Organic Evaporator and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Organic Evaporator can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

OEV@2Det: A damaging detonation occurs in the Organic Evaporator following a detonation or deflagration in another process vessel that provides an ignition source.

OEV@2Def: A damaging deflagration occurs in the Organic Evaporator following a detonation or deflagration in another process vessel that provides an ignition source.

nOEV-Exp: No damaging explosion occurs in the Organic Evaporator.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 45, 47, 78, and 81. The answers to this question are used in the logic to determine the outcome probabilities in Questions 95, 105, 106, 107, 108, and 124. Six cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 4 This case includes the sequences in which a prior event has ruptured the Organic Evaporator precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 5 This case includes the sequences in which a prior event has not occurred in the Organic Evaporator and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].

- Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 83: Does an explosive concentration accumulate in Organic Evaporator Condensate Tank?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the OECT without the presence of an ignition source. The two outcomes defined for this question are as follows:

- ConOECT2: An explosive concentration accumulates in the Organic Evaporator Condensate Tank.
- nCon-OECT: An explosive concentration does not accumulate in the Organic Evaporator Condensate Tank.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Organic Evaporator Condensate Tank. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 84 and 125.

The case structure is simplified by not considering the possibility of any prior events with the Organic Evaporator Condensate Tank which would prevent the buildup of an explosive concentration in the Organic Evaporator Condensate Tank. The possibility of prior events with the Organic Evaporator Condensate Tank is included in Question 84. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-OECTII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-OECTSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 84: Does a deflagration/detonation of the Organic Evaporator Condensate tank occur?

If an explosive concentration occurs in the Organic Evaporator Condensate Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Organic Evaporator Condensate Tank can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- OECT@2Det: A damaging detonation occurs in the Organic Evaporator Condensate Tank following a detonation or deflagration in another process vessel that provides an ignition source.
- OECT@2Def: A damaging deflagration occurs in the Organic Evaporator Condensate Tank following a detonation or deflagration in another process vessel that provides an ignition source.
- nOECT-Ex: No damaging explosion occurs in the Organic Evaporator Condensate Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 49, 51, 78, and 83. The answers to this question are used in the logic to determine the outcome probabilities in Questions 95, 105, 107, 108, 109, and 125. Six cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Organic Evaporator Condensate Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Organic Evaporator Condensate Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Organic Evaporator Condensate Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 4 This case includes the sequences in which a prior event has ruptured the Organic Evaporator Condensate Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.
- Case 5 This case includes the sequences in which a prior event has not occurred in the Organic Evaporator Condensate Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].
- Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous

cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 85: Does an explosive concentration accumulate in Precipitate Reactor Feed Tank?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the PRFT without the presence of an ignition source. The two outcomes defined for this question are as follows:

ConPRFT2: An explosive concentration accumulates in the Precipitate Reactor Feed Tank.

nConPRFT: An explosive concentration does not accumulate in the Precipitate Reactor Feed Tank.

This is a Type 6 question and uses previously quantified parameters [60, 65, 69, 70, 71, 90, 118, 135, and 136] and a user defined function to determine the probability that an explosive concentration will occur in the Precipitate Reactor Feed Tank. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 86 and 126.

The case structure is simplified by not considering the possibility of any prior events with the Precipitate Reactor Feed Tank which would prevent the buildup of an explosive concentration in the Precipitate Reactor Feed Tank. The possibility of prior events with the Precipitate Reactor Feed Tank is included in Question 86. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PRFTII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PRFTSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 86: Does a deflagration/detonation occur in the Precipitate Reactor Feed Tank?

If an explosive concentration occurs in the Precipitate Reactor Feed Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Precipitate Reactor Feed Tank can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

PRFT@2Det: A damaging detonation occurs in the Precipitate Reactor Feed Tank following a detonation or deflagration in another process vessel that provides an ignition source.

PRFT@2Def: A damaging deflagration occurs in the Precipitate Reactor Feed Tank following a detonation or deflagration in another process vessel that provides an ignition source.

nPRFT-Exp: No damaging explosion occurs in the Precipitate Reactor Feed Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 53, 55, 78, and 85. The answers to this question are used in the logic to determine the outcome probabilities in Questions 95, 97, 105, 108, 109, and 126. Six cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 4 This case includes the sequences in which a prior event has ruptured the Precipitate Reactor Feed Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 5 This case includes the sequences in which a prior event has not occurred in the Precipitate Reactor Feed Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].

Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 87: Does an explosive concentration accumulate in the Precipitate Reactor Bottoms Tank?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the PRBT without the presence of an ignition source. The two outcomes defined for this question are as follows:

ConPRBT2: An explosive concentration accumulates in the Precipitate Reactor Bottoms Tank.

nConPRBT: An explosive concentration does not accumulate in the Precipitate Reactor Bottoms Tank.

This is a Type 6 question and uses previously quantified parameters [60, 66, 67, 70, 71, 90, 95, and 108] and a user defined function to determine the probability that an explosive concentration will occur in the Precipitate Reactor Bottoms Tank. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 88 and 130.

The case structure is simplified by not considering the possibility of any prior events with the Precipitate Reactor Bottoms Tank which would prevent the buildup of an explosive concentration in the Precipitate Reactor Bottoms Tank. The possibility of prior events with the Precipitate Reactor Bottoms Tank is included in Question 88. Five cases are used to develop the outcome probabilities as follows:

- Case 1** This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2** This case includes all sequences in which the class of accidents is internal-energetic and the bulk nitrogen tank has failed as an initiator. Since the CPC nitrogen is a backup system, failure of the system supply as an initiator cannot lead to an explosive concentration in the PRBT. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3** This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PRBTII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4** This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PRBTSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5** The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 88: Does a deflagration/detonation occur in the Precipitate Reactor Bottoms Tank [PRBT]?

If an explosive concentration occurs in the Precipitate Reactor Bottoms Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Precipitate Reactor Bottoms Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

PRBT@2Det: A damaging detonation occurs in the Precipitate Reactor Bottoms Tank following a detonation or deflagration in another process vessel that provides an ignition source.

PRBT@2Def: A damaging deflagration occurs in the Precipitate Reactor Bottoms Tank following a detonation or deflagration in another process vessel that provides an ignition source.

nPRBT-Ex: No damaging explosion occurs in the Precipitate Reactor Bottoms Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 58, 60, 78, and 87. The answers to this question are used in the logic to determine the outcome probabilities in Questions 96, 98, 99, 100, 104, and 130. Six cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Precipitate Reactor Bottoms Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Precipitate Reactor Bottoms Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor Bottoms Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 4 This case includes the sequences in which a prior event has ruptured the Precipitate Reactor Bottoms Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 5 This case includes the sequences in which a prior event has not occurred in the Precipitate Reactor Bottoms Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].

Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous

cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 89: Does an explosive concentration accumulate in the Slurry Mix Evaporator Tank [SME]?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the SME without the presence of an ignition source. The two outcomes defined for this question are as follows:

ConSME2: An explosive concentration accumulates in the Slurry Mix Evaporator Tank.

nConSME: An explosive concentration does not accumulate in the Slurry Mix Evaporator Tank.

This is a Type 6 question and uses previously quantified parameters [60, 61, 62, 64, 66, 67, 70, 71, 90, 93, 95, 98, 103, and 108] and a user defined function to determine the probability that an explosive concentration will occur in the Slurry Mix Evaporator Tank. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 90 and 131.

The case structure is simplified by not considering the possibility of any prior events with the Slurry Mix Evaporator Tank which would prevent the buildup of an explosive concentration in the Slurry Mix Evaporator Tank. The possibility of prior events with the Slurry Mix Evaporator Tank is included in Question 90. Five cases are used to develop the outcome probabilities as follows:

- Case 1** This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2** This case includes all sequences in which the class of accidents is internal-energetic and the bulk nitrogen tank has failed as an initiator. Since the CPC nitrogen is a backup system, failure of the system supply as an initiator cannot lead to an explosive concentration in the SME. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 3** This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-SMEIII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4** This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-SMESI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 90: Does a deflagration/detonation occur in the Slurry Mix Evaporator Tank [SME]?

If an explosive concentration occurs in the Slurry Mix Evaporator Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Slurry Mix Evaporator Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

SME@2Det: A damaging detonation occurs in the Slurry Mix Evaporator Tank following a detonation or deflagration in another process vessel that provides an ignition source.

SME@2Def: A damaging deflagration occurs in the Slurry Mix Evaporator Tank following a detonation or deflagration in another process vessel that provides an ignition source.

nSME-Ex: No damaging explosion occurs in the Slurry Mix Evaporator Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 62, 64, 78, and 89. The answers to this question are used in the logic to determine the outcome probabilities in Questions 96, 98, 99, 100, and 131. Six cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Slurry Mix Evaporator Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Slurry Mix Evaporator Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Slurry Mix Evaporator Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 4 This case includes the sequences in which a prior event has ruptured the Slurry Mix Evaporator Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 5 This case includes the sequences in which a prior event has not occurred in the Slurry Mix Evaporator Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].

- Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 91: Does an explosive concentration accumulate in the Sludge Receipt and Adjustment Tank [SRAT]?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the SRAT without the presence of an ignition source. The two outcomes defined for this question are as follows:

- ConSRAT2: An explosive concentration accumulates in the Sludge Receipt Adjustment Tank.
- nConSRAT: An explosive concentration does not accumulate in the Sludge Receipt Adjustment Tank.

This is a Type 6 question and uses previously quantified parameters [60, 61, 62, 63, 64, 66, 67, 70, 71, 90, 93, 95, 98, 103, and 108] and a user defined function to determine the probability that an explosive concentration will occur in the Sludge Receipt Adjustment Tank. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 92 and 132.

The case structure is simplified by not considering the possibility of any prior events with the Sludge Receipt Adjustment Tank which would prevent the buildup of an explosive concentration in the Sludge Receipt Adjustment Tank. The possibility of prior events with the Sludge Receipt Adjustment Tank is included in Question 92. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic and the bulk nitrogen tank has failed as an initiator. Since the CPC nitrogen is a backup system, failure of the system supply as an initiator cannot lead to an explosive concentration in the SRAT. The outcome probability assigned in 1.0 in Branch 2, there is no explosive concentration.
- Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-SRATII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
- Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using

FUN-SRATSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1

Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 92: Does a deflagration/detonation occur in the Sludge Receipt and Adjustment Tank [SRAT]?

If an explosive concentration occurs in the Sludge Receipt Adjustment Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Sludge Receipt Adjustment Tank can spill the contents of the vessel to the Chemical Process Cell; blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

SRAT@2Det: A damaging detonation occurs in the Sludge Receipt Adjustment Tank following a detonation or deflagration in another process vessel that provides an ignition source.

SRAT@2Def: A damaging deflagration occurs in the Sludge Receipt Adjustment Tank following a detonation or deflagration in another process vessel that provides an ignition source.

nSRAT-Ex: No damaging explosion occurs in the Sludge Receipt Adjustment Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 66, 68, 78, and 91. The answers to this question are used in the logic to determine the outcome probabilities in Questions 96, 98, 101, 102, and 132. Six cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Sludge Receipt Adjustment Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Sludge Receipt Adjustment Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Sludge Receipt Adjustment Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 4 This case includes the sequences in which a prior event has ruptured the Sludge Receipt Adjustment Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 5 This case includes the sequences in which a prior event has not occurred in the Sludge Receipt Adjustment Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the

ignition source). The outcome probability assigned is 0.001 in Branch 1, there is a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].

Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 93: Does an explosive concentration accumulate in the Melter Feed Tank [MFT]?

The cut sets solved by the UFUN in this question have been modified to calculate the probability of an explosive concentration in the MFT without the presence of an ignition source. The two outcomes defined for this question are as follows:

ConMFT2: An explosive concentration accumulates in the Melter Feed Tank.

nConMFT: An explosive concentration does not accumulate in the Melter Feed Tank.

This is a Type 6 question and uses previously quantified parameters [60, 66, 67, 70, 71, 90, 95, and 108] and a user defined function to determine the probability that an explosive concentration will occur in the Melter Feed Tank. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Questions 94 and 133.

The case structure is simplified by not considering the possibility of any prior events with the Melter Feed Tank which would prevent the buildup of an explosive concentration in the Melter Feed Tank. The possibility of prior events with the Melter Feed Tank is included in Question 94. Five cases are used to develop the outcome probabilities as follows:

Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2, there is no explosive concentration.

Case 2 This case includes all sequences in which the class of accidents is internal-energetic and the bulk nitrogen tank has failed as an initiator. Since the CPC nitrogen is a backup system, failure of the system supply as an initiator cannot lead to an explosive concentration in the MFT. The outcome probability assigned in 1.0 in Branch 2, there is no explosive concentration.

Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-MFTIII and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1

Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using

FUN-MFTSI and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1

- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 94: **Does a deflagration/detonation occur in the Melter Feed Tank [MFT]?**

If an explosive concentration occurs in the Melter Feed Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Melter Feed Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

MFT@2Det: A damaging detonation occurs in the Melter Feed Tank following a detonation or deflagration in another process vessel that provides an ignition source.

MFT@2Def: A damaging deflagration occurs in the Melter Feed Tank following a detonation or deflagration in another process vessel that provides an ignition source.

nMFT-Ex: No damaging explosion occurs in the Melter Feed Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 72, 74, 78, and 93. The answers to this question are used in the logic to determine the outcome probabilities in Questions 96, 98, 102, 103, and 133. Six cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Melter Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Melter Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Melter Feed Tank. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 4 This case includes the sequences in which a prior event has ruptured the Melter Feed Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Case 5 This case includes the sequences in which a prior event has not occurred in the Melter Feed Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1, there is

a damaging detonation and 0.999 in Branch 2, there is a damaging deflagration [7].

Case 6 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 95: Does a damaging explosion occur in the Salt Process Cell Vent System [SPCV]?

Conditions in the Salt Process Cell Vent System [SPCV] are expected to be the same as the tanks exhausting into the header. Therefore an explosion in any of the SPC tanks will propagate into the header causing the header to also explode. Because of the size of the SPCV, it is expected to detonate (not deflagrate) which would produce shrapnel that could cause venting of cell tanks. There are two possible outcomes as follows:

SPCV-Exp2: A damaging explosion occurs in the Salt Process Cell Vent System following the second round of potential explosions.

nSPCV-Ex: A damaging explosion does not occur in the Salt Process Cell Vent System following the second round of potential explosions.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 37, 75, 80, 82, 84, and 86. The answers to this question are not used in the remaining logic but are instead used in some of the output binners to designate that tank venting has occurred thus resulting in source term release.

Five cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which the SPC cell covers have fallen due to a seismic event. If the cell covers fall, the SPCV piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.

Case 2 This case includes all sequences in which the SPCV has previously exploded. A previous explosion is assumed to damage the piping to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.

Case 3 This case includes all sequences in which one of the SPC vessels has detonated in the second round. A detonation in any SPC vessel is assumed to cause the SPCV to explode. An outcome probability of 1.0 is assigned Branch 1.

Case 4 This case includes all sequences in which one of the SPC vessels has deflagrated in the second round. A deflagration in any SPC vessel is assumed to cause the SPCV to explode. An outcome probability of 1.0 is assigned Branch 1.

- Case 5 The default case includes all sequences remaining and assumes that there is no other mechanism for an explosion in the SPCV. An outcome probability of 1.0 is assigned Branch 2.

Question 96: Does a damaging explosion occur in the Chemical Process Cell Vent System [CPCV]?

Conditions in the Chemical Process Cell Vent System [CPCV] are expected to be the same as the tanks exhausting into the header. Therefore an explosion in any of the CPC tanks will propagate into the header causing the header to also explode. Because of the size of the CPCV, it is expected to detonate (not deflagrate) which would produce shrapnel that could cause venting of cell tanks. There are two possible outcomes as follows:

- CPCV-Exp2: A damaging explosion occurs in the Chemical Process Cell Vent System following the second round of potential explosions.
- nCPCV-Ex: No damaging explosion occurs in the Chemical Process Cell Vent System following the second round of potential explosions.

This is a Type 2 question. The answer is dependent on the outcome of previous Question 56, 76, 88, 90, 92, , and 94. The answers to this question are not used in the remaining logic but are instead used in some of the output binnings to designate that tank venting has occurred thus resulting in release of radioactive material. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the CPC cell covers have fallen due to a seismic event. If the cell covers fall, the CPCV piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 2 This case includes all sequences in which the CPCV has previously exploded. A previous explosion is assumed to damage the piping to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 3 This case includes all sequences in which one of the CPC vessels has detonated in the second round. A detonation in any CPC vessel is assumed to cause the CPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which one of the CPC vessels has deflagrated in the second round. A deflagration in any CPC vessel is assumed to cause the CPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 The default case includes all sequences remaining and assumes that there is no other mechanism for an explosion in the CPCV. An outcome probability of 1.0 is assigned Branch 2.

Question 97: Does an energetic event in the SPC fail the removable wall between the SPC and the CPC?

The Salt Process Cell and the Chemical Process Cell are separated by a removable [from above] partition. Some events in the SPC are assumed to be sufficiently energetic to displace the partition from its supports, possibly causing damage to the tanks, piping, etc. in the CPC. There are two defined outcomes as follows:

FailWall: The wall separating the Salt Process Cell and the Chemical Process Cell is failed.

nFailWal: The wall separating the Salt Process Cell and the Chemical Process Cell is not failed.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 55 and 86 and are used in the logic to determine the outcome probabilities for Questions 99, 100, 101, 102, 103, 135, and 140. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a detonation has occurred in the Precipitate Reactor Feed Tank which is adjacent to the partition. An outcome probability of 0.5 is assigned to Branch 1, FailWall and an outcome probability of 0.5 is assigned to Branch 2, nFailWal [7].

Case 2 The default case includes all sequences remaining. It is expected that all sequences in which the wall could be failed are included in previous cases. An outcome probability of 1.0 is assigned Branch 2, nFailWal.

Question 98: Do the cell covers for the Chemical Process Cell dislodge and fall following an energetic event?

The cell covers in the CPC can be dislodged and fall as a result of an energetic event in the CPC. The falling cell covers can damage equipment and piping in the cell. There are two defined outcomes as follows:

CPCovFl: The cell covers in the Chemical Process Cell dislodge and fall due to an in-cell energetic event.

nCPCovFl: The cell covers in the Chemical Process Cell are in place.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 56, 60, 64, 68, 74, 78, 88, 90, 92, and 94. The answers to this question are used in the logic to determine the outcome probabilities in Questions 99, 100, 101, 102, 103, 134, and 141. Five cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which no energetic event has occurred in the CPC and a seismic event has not dislodged the cell covers. An outcome probability of 1.0 is assigned Branch 2, the cell covers are not dislodged due to an energetic event.

- Case 2 This case includes all sequences in which a seismic event has caused the cell covers to be dislodged. An outcome probability of 1.0 is assigned Branch 2, the cell covers are not dislodged due to an energetic event.
- Case 3 This case includes all sequences in which a detonation or deflagration has occurred in a CPC vessel or piping during the first round of energetic events. An outcome probability of 1.0 is assigned Branch 1, the cell covers are dislodged due to an energetic event.
- Case 4 This case includes all sequences in which a detonation or deflagration has occurred in a CPC vessel or piping during the second round of energetic events. An outcome probability of 1.0 is assigned Branch 1, the cell covers are dislodged due to an energetic event.
- Case 5 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 99: Does splashing [spillage] of the Precipitate Reactor Bottoms Tank contents occur?

If the Precipitate Reactor Bottoms Tank [PRBT] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PRBT can be caused by falling cell covers, by shaking during a Seismic event, by a crane load drop accident, by an explosion associated with the PRBT, or by damage from a failed SPC/CPC removable wall. The PRBT is also located next to the Slurry Mix Evaporator [SME]. A detonation or deflagration in the SME may generate shrapnel which can damage the PRBT. Spilling the contents of the PRBT is of concern because the contents are radioactive. There are two defined outcomes as follows:

- PRBT-Spl: The contents of the Precipitate Reactor Bottoms Tank are spilled into the Chemical Process Cell.
- nPRBT-Spl: The contents of the Precipitate Reactor Bottoms Tank are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 58, 60, 64, 88, 90, and 98 and are used in the logic to determine the outcome probabilities in Questions 130 and 142. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which an energetic event that could cause possible damage to the PRBT has not occurred. Spillage of the tank contents will not occur. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the PRBT has been ruptured due to a seismic event or a crane load drop accident. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.

- Case 3 This case includes all sequences in which there is a detonation in the Precipitate Reactor Bottoms Tank. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the removable wall between the CPC and the SPC has failed. Spillage of the tank contents is possible. An outcome probability of 0.5 is assigned Branch 1 and Branch 2. ****SAMPLED VARIABLE****
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation of the Slurry Mix Evaporator, which is adjacent to the PRBT. The falling cell covers or shrapnel from the detonating SME can penetrate the PRBT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2. ****SAMPLED VARIABLE****
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration of the Slurry Mix Evaporator, which is adjacent to the PRBT. The falling cell covers or shrapnel from the vent piping above the deflagrating SME can penetrate the PRBT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 7 This case includes all sequences in which the cell covers are displaced and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 8 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the Precipitate Reactor Bottoms Tank can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 100: Does splashing [spillage] of the Slurry Mix Evaporator Tank contents occur?

If the Slurry Mix Evaporator [SME] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the SME can be caused by falling cell covers, by shaking during a Seismic event, by a crane load drop accident, by an explosion associated with the SME, or by damage from a failed SPC/CPC removable wall. The SME is also located next to the PRBT. An energetic event in the PRBT may generate shrapnel and cause damage to the SME. Spilling the contents of the SME is of concern because the contents are radioactive. There are two defined outcomes as follows:

- SME-Spl: The contents of the Slurry Mix Evaporator are spilled into the Chemical Process Cell.
- nSME-Spl: The contents of the Slurry Mix Evaporator are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 60, 62, 64, 88, 97, and 98 and are used in the logic to determine the outcome probabilities in Questions 131 and 143. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which an energetic event that could cause possible damage to the SME has not occurred. Spillage of the tank contents will not occur. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a seismic initiated rupture of the SME or the SME is ruptured due to a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a detonation of the Slurry Mix Evaporator. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the cell covers are displaced and fall and a detonation occurs in the Precipitate Reactor Bottoms Tank, which is adjacent to the SME. The falling cell covers or shrapnel from the exploding PRBT can penetrate the SME causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
 ****SAMPLED VARIABLE****
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and a deflagration occurs in the Precipitate Reactor Bottoms Tank, which is adjacent to the SME. The falling cell covers or shrapnel from the vent piping above the deflagrating PRBT can penetrate the SME causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
 ****SAMPLED VARIABLE****
- Case 6 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The SME is separated from this wall by the PRBT. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
 ****SAMPLED VARIABLE****
- Case 7 This case includes all sequences in which the cell covers are displaced and fall. The falling cell covers can damage the SME. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 8 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the Slurry Mix Evaporator can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question-101: Does splashing [spillage] of the Sludge Receipt and Adjustment Tank contents occur?

If the Sludge Receipt Adjustment Tank [SRAT] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the SRAT can be caused by falling cell covers, by shaking during a Seismic event, by a crane load drop accident, by an explosion associated with the SRAT, or by damage from a failed SPC/CPC removable wall. Spilling the contents of the SRAT is of concern because the contents are radioactive. There are two defined outcomes as follows:

SRAT-Spl: The contents of the SRAT are spilled into the Chemical Process Cell.

nSRAT-Spl: The contents of the SRAT are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 66, 68, 92, 97, and 98 and are used in the logic to determine the outcome probabilities in Questions 132 and 144. Six cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which an energetic event that could cause possible damage to the SRAT has not occurred. Spillage of the tank contents will not occur. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a seismic initiated rupture of the SRAT or the SRAT is ruptured due to a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a detonation in the SRAT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the cell covers are displaced and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 5 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The SRAT is separated from this wall by three other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 6 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the SRAT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 102: Does splashing [spillage] of the Recycle Collection Tank contents occur?

If the Recycle Collection Tank [RCT] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the RCT can be caused by falling cell covers, by shaking during a Seismic event, by a crane load drop accident and by explosion driven shrapnel from adjacent tanks. Spilling the contents of the RCT is of concern because the contents are radioactive. There are two defined outcomes as follows:

RCT-Spl: The contents of the RCT are spilled into the Chemical Process Cell.

nRCT-Spl: The contents of the RCT are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 68, 70, 74, 92, 94, 97, and 98 and are used in the logic to determine the outcome probabilities in Question 145. Seven cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which an energetic event that could cause possible damage to the RCT has not occurred. Spillage of the tank contents will not occur. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which there was a seismic initiated rupture of the RCT or the RCT is damaged due to a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.

Case 3 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the MFT or the SRAT, which are adjacent to the RCT. The falling cell covers or shrapnel from the exploding MFT or SRAT can penetrate the RCT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.

Case 4 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the MFT or the SRAT, which are adjacent to the RCT. The falling cell covers or shrapnel from the vent piping above the deflagrating MFT or SRAT can penetrate the RCT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
SAMPLED VARIABLE

Case 5 This case includes all sequences in which the cell covers are displaced and fall. The falling cell covers can damage the RCT. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
SAMPLED VARIABLE

Case 6 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The RCT is separated from this wall by four other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
SAMPLED VARIABLE

- Case 7 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the RCT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 103: Does splashing [spillage] of the Melter Feed Tank contents occur?

If the Melter Feed Tank [MFT] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the MFT can be caused by falling cell covers, by shaking during a Seismic event, by a crane load drop accident, by an explosion associated with the MFT, or by damage from a failed SPC/CPC removable wall. Spilling the contents of the MFT is of concern because the contents are radioactive. There are two defined outcomes as follows:

- MFT-Spl: The contents of the MFT are spilled into the Chemical Process Cell.
- nMFT-Spl: The contents of the MFT are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 72, 74, 94, 97, and 98 and are used in the logic to determine the outcome probabilities in Questions 133 and 146. Six cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which an energetic event that could cause possible damage to the MFT has not occurred. Spillage of the tank contents will not occur. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a seismic initiated rupture of the MFT or a rupture due to a crane drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a detonation in the MFT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the cell covers are displaced and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 5 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The MFT is separated from this wall by five other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 6 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the MFT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 104: Does an energetic event in the CPC fail the removable wall between the SPC and the CPC?

The Salt Process Cell and the Chemical Process Cell are separated by a removable [from above] partition. Some events in the CPC are assumed to be sufficiently energetic to displace the partition from its supports, possibly causing damage to the tanks, piping, etc. in the SPC. There are two defined outcomes as follows:

FailWall: The wall separating the Salt Process Cell and the Chemical Process Cell is failed.

nFailWal: The wall separating the Salt Process Cell and the Chemical Process Cell is not failed.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 60 and 88 and are used in the logic to determine the outcome probabilities for Questions 106, 107, 108, 109, 135, and 140. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a detonation has occurred in the PRBT which is adjacent to the partition. An outcome probability of 0.5 is assigned to Branch 1 and an outcome probability of 0.5 is assigned to Branch 2 [7].

Case 2 The default case includes all sequences remaining. It is expected that all sequences in which the wall could be failed are included in previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 105: Do the cell covers for the Salt Process Cell dislodge and fall following an energetic event?

The cell covers in the SPC can be dislodged and fall as a result of an energetic event in the SPC. The falling cell covers can damage equipment and piping in the cell. There are two defined outcomes as follows:

SPCovFl: The cell covers dislodge and fall due to an in-cell energetic event.

nSPCovFl: The cell covers do not fall as a result of an energetic event.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 37, 43, 47, 51, 55, 80, 82, 84, and 86 and are used in the logic to determine the outcome probabilities in Questions 106, 107, 108, 109, 116, 127, 128, 129, 131, 132, 133, and 134. Five cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which there were no energetic events in the SPC and the cell covers were not dislodged previously by a seismic event. An outcome probability of 1.0 is assigned Branch 2.

- Case 2 This case includes all sequences in which the cell covers were dislodged previously by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which there was a detonation in one of the SPC vessels. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which there was a deflagration in one of the SPC vessels. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 106: Does splashing [spillage] of the Precipitate Reactor contents occur?

If the Precipitate Reactor is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PR can be caused by falling cell covers, by shaking during a Seismic event, by a crane load drop accident, by an explosion associated with the PR, or by damage from a failed SPC/CPC removable wall. The PR is located next to the OEV. An energetic event in the OEV may generate shrapnel and cause damage to the PR. Spilling the contents of the Precipitate Reactor is of concern because the contents are radioactive. There are two defined outcomes as follows:

- PRx-Spl: The contents of the Precipitate Reactor are spilled into the Salt Process Cell.
- nPRx-Spl: The contents of the Precipitate Reactor are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 41, 43, 47, 80, 82, 104, and 105 and are used in the logic to determine the outcome probabilities in Questions 115, 117, 123, and 136. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which there was no explosion of the PR or the OEV, the cell covers were not dislodged previously by an energetic event or seismic event, the PR was not damaged by a crane load drop accident, and the PR was not ruptured by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a rupture of the Precipitate Reactor due to a seismic cell cover strike, seismic damage to the PR, or a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was a detonation of the Precipitate Reactor. An outcome probability of 1.0 is assigned Branch 1.

- Case 4 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the OEV, which is adjacent to the PR. The falling cell covers or shrapnel from the exploding OEV can penetrate the PR causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
 ** SAMPLED VARIABLE**
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the OEV which is adjacent to the PR. The falling cell covers or shrapnel from the vent piping above the deflagrating OEV can penetrate the PR causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
 SAMPLED VARIABLE
- Case 6 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **SAMPLED VARIABLE**
- Case 7 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The PR is separated from this wall by three other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
 SAMPLED VARIABLE
- Case 8 The default case includes all sequences remaining and assumes that all means by which the PR can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 107: Does splashing [spillage] of the contents of the Organic Evaporator tank occur?

If the OEV is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the OEV can be caused by falling cell covers, by shaking during a seismic event, by a crane load drop accident, by an explosion associated with the OEV, or by damage from a failed SPC/CPC removable wall. The OEV is located between the PR and OECT. An energetic event in the PR or OECT may generate shrapnel and cause damage to the OEV. Spilling the contents of the Organic Evaporator is of concern primarily because part of the spilled benzene will evaporate and may lead to a deflagration in the Salt Process Cell. There are two defined outcomes as follows:

OEV-Spl: The contents of the OEV are spilled into the Salt Process Cell.

nOEV-Spl: The contents of the OEV are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 43, 45, 47, 51, 80, 82, 104, and 105 and are used in the logic to determine the outcome probabilities in Questions 115, 118, 121, 122, 124, 137, and 147. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which there was no explosion of the PR, OECT, or the OEV, the cell covers were not dislodged previously by an energetic event or seismic event, the OEV was not damaged by a crane load drop accident, and the OEV was not ruptured by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a rupture of the OEV due to a seismic cell cover strike, seismic damage to the OEV, or a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was a detonation of the OEV. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the PR or OECT which are adjacent to the OEV. The falling cell covers or shrapnel from the exploding PR or OECT can penetrate the OEV causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
SAMPLED VARIABLE
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the PR or OECT which are adjacent to the OEV. The falling cell covers or shrapnel from the vent piping above the deflagrating PR or OECT can penetrate the OEV causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
SAMPLED VARIABLE
- Case 6 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **SAMPLED VARIABLE**
- Case 7 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The OEV is separated from this wall by two other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
SAMPLED VARIABLE
- Case 8 The default case includes all sequences remaining and assumes that all means by which the OEV can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 108: Does splashing [spillage] of the contents of the Organic Evaporator Condensate tank occur?

If the OECT is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the OECT can be caused by falling cell covers, by shaking during a seismic event, by a crane load drop accident, by an explosion associated with the OECT, or by damage from a failed SPC/CPC removable wall. The OECT is located between the PRFT and OEV. An energetic event in the PRFT or OEV may generate shrapnel and cause damage to the OECT. Spilling the contents of the OECT is of concern primarily because part of the spilled benzene

will evaporate and may lead to a deflagration in the Salt Process Cell. There are two defined outcomes as follows:

- OECT-Spl: The contents of the OECT are spilled into the Salt Process Cell.
- nOECT-Spl: The contents of the OECT are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 47, 49, 51, 55, 82, 84, 86, 104, and 105 and are used in the logic to determine the outcome probabilities in Questions 115, 119, 121, 122, 125, 138, and 147. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which there was no explosion of the PRFT, OECT, or the OEV, the cell covers were not dislodged previously by an energetic event or seismic event, the OECT was not damaged by a crane load drop accident, and the OECT was not ruptured by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a rupture of the OECT due to a seismic cell cover strike, seismic damage to the OECT, or a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was a detonation of the OECT. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the PRFT or OEV which are adjacent to the OECT. The falling cell covers or shrapnel from the exploding PRFT or OEV can penetrate the OECT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
SAMPLED VARIABLE
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the PRFT or OEV which are adjacent to the OECT. The falling cell covers or shrapnel from the vent piping above the deflagrating PRFT or OEV can penetrate the OECT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
SAMPLED VARIABLE
- Case 6 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The OECT is separated from this wall by one other tank. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
SAMPLED VARIABLE
- Case 7 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **SAMPLED VARIABLE**

- Case 8 The default case includes all sequences remaining and assumes that all means by which the OECT can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 109: Does splashing [spillage] of the contents of the Precipitate Reactor Feed Tank occur?

If the PRFT is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PRFT can be caused by falling cell covers, by shaking during a seismic event, by a crane load drop accident, by an explosion associated with the PRFT, or by damage from a failed SPC/CPC removable wall. The PRFT is located adjacent to the OECT. An energetic event in the OECT may generate shrapnel and cause damage to the PRFT. Spilling the contents of the PRFT is of concern because the contents are radioactive. There are two defined outcomes as follows:

- PRFT-Spl: The contents of the PRFT are spilled into the Salt Process Cell.
- nPRFT-Spl: The contents of the PRFT are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 51, 53, 55, 84, 86, 104, and 105 and are used in the logic to determine the outcome probabilities in Questions 115, 120, 126, and 139. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which there was no explosion of the PRFT or the OECT, the cell covers were not dislodged previously by an energetic event or seismic event, the PRFT was not damaged by a crane load drop accident, and the PRFT was not ruptured by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a rupture of the PRFT due to a seismic cell cover strike, seismic damage to the PRFT, or a crane load drop accident. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was a detonation of the PRFT. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The PRFT is adjacent to this wall. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
 SAMPLED VARIABLE
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the OECT which is adjacent to the PRFT. The falling cell covers or shrapnel from the exploding OECT can penetrate the PRFT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
 ** SAMPLED VARIABLE**
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the OECT which is adjacent to the PRFT.

The falling cell covers or shrapnel from the vent piping above the deflagrating OECT can penetrate the PRFT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.

****SAMPLED VARIABLE****

Case 7 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. ****SAMPLED VARIABLE****

Case 8 The default case includes all sequences remaining and assumes that all means by which the PRFT can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 110: Does the DWPF Vitrification Building collapse following a seismic event?

The DWPF Vitrification Building houses most of the equipment and process cells required for the solidification of the high level waste. Collapse of the Vitrification Building is extremely unlikely at the ground acceleration of the design basis earthquake. Such collapse, however, will result in complete bypass of the filter system for any released radionuclides and will damage equipment and fail processes within the building. There are two defined outcomes as follows:

VB-Clpse: The Vitrification Building collapses as the result of a seismic event.

nVB-Clps: The Vitrification Building does not collapse as the result of a seismic event.

This is a Type 6 question. The answers to this question are dependent only on Question 2 and are used in the logic to determine the outcome probabilities in Question 112 and 147.

Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a seismic event is the initiating event [external class]. The fragility of the Canyon [CanyClps] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 111: Does the Sand Filter function following a seismic event?

A Sand Filter, separated from the Vitrification Building, is provided to filter the exhaust air and offgases from the Canyon. Proper operation of the filter is essential in preventing the release of radionuclides to the environment, particularly in the event of a process upset or accident that results in the release of radioactive material from the process vessels or piping. Damage to the Sand Filter could occur during a Seismic event. There are two defined outcomes as follows:

fSndFlt: The Sand Filter is failed as the result of a seismic event.

nfSndFlt: The Sand Filter is not failed as the result of a seismic event.

This is a Type 6 question. The answers to this question, which are dependent on the outcome of Question 2 are not used in the logic to determine the outcome probabilities for other questions but are used in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a seismic event is the initiating event [external class]. The fragility of the Sand Filter [FiltFr] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 112: Do the Building Exhaust Ducts from Zone 1 to the Sand Filter function following a seismic event?

The Zone 1 exhaust ducts collect offgas and ventilation air from the canyon process areas, process vessels and enclosures, and the melter and directs the exhaust to the Sand Filter. Collapse of the building during a Seismic event could cause collapse and blockage of the exhaust ducts or the ducts could collapse directly during a Seismic event. In either event exhaust flow to the Sand Filter is stopped. Any radionuclides released from primary confinement will leak from the building. There are two defined outcomes as follows:

failDuct: The exhaust ducts are failed as the result of a seismic event.

nfailDct: The exhaust ducts are not failed as the result of a seismic event.

This is a Type 6 question. The answers to this question, which are dependent on the outcomes of Questions 2 and 110, are not used in the logic to determine the outcome probabilities for other questions but are used in the source term binning file. Three cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a seismic event is the initiating event [external class] and the Canyon has collapsed. If the building has collapsed then the exhaust ducts are assumed to collapse. The outcome probability for Branch 1 is 1.0.

Case 2 This case includes all sequences in which a seismic event is the initiating event [external class] and the Canyon has not collapsed. The fragility of the exhaust ducts [DuctFr] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 113: What is the condition of the Zone 1 Exhaust Fan System?

The operation of the Zone 1 exhaust fans is essential during normal or off normal operation to [1] maintain a negative pressure within the Canyon and [2] transport any radionuclides released from primary confinement to the Sand Filter. Failure of the exhaust fans in conjunction with a failure of primary confinement would result in the release of radionuclides to the environment. There are two defined outcomes as follows:

- Fan-Fail: The Zone 1 exhaust fans are failed.
- nFanFail: The Zone 1 exhaust fans are not failed.

This is a Type 8 question and defines a parameter that is also used in calculations to determine the outcome probabilities of later Question 114. The parameter is as follows:

- Arg [128] FailFan, a logical variable that indicates the state of the Zone 1 exhaust fan system. The parameter is assigned a value {+1.0} if the system is failed and {0.0} if the system is available.

The outcome probabilities for this question are dependent on the outcomes of Questions 1, 3, 8, 9, and 18 and are used in the logic to determine the outcome probabilities in Questions 121 and 122 and are used to determine the value assigned the above parameter. Twelve cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes all sequences in which the accident is an internal-energetic scenario and both the normal and the emergency power systems have failed. The fans will not operate without power and the outcome probability specified is 1.0 for Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 2 This case includes all sequences in which the accident is either a limited leak, a crane load drop, or a limited miscellaneous scenario and both the normal and the emergency power systems have failed. The fans will not operate without power and the outcome probability specified is 1.0 for Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 3 This case includes all sequences in which an internal-energetic event has occurred, normal electric power has failed, but emergency electrical power and the instrument air system are available. The outcome probability for Branch 1 is calculated as a function of FanLmda1 and FanTau1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 4 This case includes all sequences in which the accident is either a limited leak, a crane load drop, or a limited miscellaneous scenario and the normal power system has failed. The emergency power system and the instrument air system are still available. The outcome probability for Branch 1 is calculated as a function of FanLmda1 and FanTau1. The outcome probability for Branch 2 is 1.0 less the probability assigned

Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

- Case 5 This case includes all sequences in which an internal-energetic event has occurred, normal electric power and the instrument air system have failed, but emergency electrical power is still available. The outcome probability for Branch 1 is calculated as a function of FanLmda2 and FanTau2. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 6 This case includes all sequences in which the accident is either a limited leak, a crane load drop, or a limited miscellaneous scenario and the normal power system and the instrument air system have failed. The emergency power system is still available. The outcome probability for Branch 1 is calculated as a function of FanLmda2 and FanTau2. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 7 This case includes all sequences in which the accident is either an internal-energetic scenario, a limited leak, a crane load drop, or a limited miscellaneous scenario and the normal power system, the instrument air system, and the emergency power system are all available. The outcome probability for Branch 1 is calculated as a function of FanLmda3 and FanTau3. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 8 This case includes all sequences in which an external event has occurred and both normal and emergency electric power have failed. The fans will not operate without power and the outcome probability specified is 1.0 for Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome.
- Case 9 This case includes all sequences in which an external event has occurred and normal electric power has failed. Emergency electrical power and the instrument air system are available. The outcome probability for Branch 1 is calculated as a function of FanLmda1 and FanTau1, FanFr, and FanRn1 and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.
- Case 10 This case includes all sequences in which an external event has occurred and normal electric power and the instrument air system have failed. Emergency electrical power is available. The outcome probability for Branch 1 is calculated as a function of FanLmda2 and FanTau2, FanFr,

and FanRn2 and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 11 This case includes all sequences in which an external event has occurred and the normal and emergency electrical power systems and the instrument air system are available. The outcome probability for Branch 1 is calculated as a function of FanLmda3 and FanTau3, FanFr, and FanRn3 and MsTmEx. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1. The parameter, FailFan, is assigned a value of {+1.0} when Branch 1 is selected as the outcome and a value of {0.0} when Branch 2 is selected as the outcome.

Case 12 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2. The parameter, FailFan, is assigned a value of {0.0} when branch 2 is selected as the outcome.

Question 114: Does a deflagratable concentration occur in the SPC due to Vessel Overpressurization?

As indicated previously benzene may be present in any or all of the tanks in the Salt Process Cell. Overpressurization of these vessels will cause release of benzene vapors into the cell which if coupled with a loss of ventilation flow (failure to sweep vapors from the cell) and an ignition source could cause a cell deflagration. A cell deflagration will raise the cell covers and could lead to damaged process equipment in the cell. A fault tree was constructed to calculate the frequency of this SPC overpressurization deflagration for all credible initiators [5]. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of a deflagratable concentration. There are two defined outcomes as follows:

SPCDefOP: A deflagratable concentration occurs in the SPC due to vessel overpressurization.

nSPCDefOP: A deflagratable concentration does not occur in the SPC due to vessel overpressurization.

This is a Type 6 question and uses previously quantified parameters [60, 70, 71, 90, and 128] and a user defined function to determine the probability that a deflagratable concentration will occur in the SPC. The user function includes information from solution of the fault tree for the SPC overpressure deflagration. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Question 115.

The case structure is simplified by not considering the possibility of prior rupture of items in the SPC that would prevent overpressurization. The possibility of prior rupture of SPC items assumed to prevent overpressurization are included in Question 115. Four cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which the accident is not an internal-energetic or external (seismic) scenario. A SPC overpressure deflagration

cannot occur for any other accident type. An outcome probability of 1.0 is assigned Branch 2.

- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-SPC and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-SPCS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
- Case 4 The default case includes all sequences remaining. It is expected that all sequences in which a deflagratable concentration from vessel overpressurization could occur are included in previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 115: Does a vessel overpressurization in the Salt Process Cell result in a deflagration in the Salt Process Cell?

If a deflagratable concentration occurs in the SPC and an ignition source is available it is assumed that a damaging deflagration will follow. The fault tree for the SPC overpressurization deflagration includes the probability of an ignition source. Therefore, if Question 114 indicates that an explosive concentration is available then a deflagration will follow. A deflagration in the SPC can blow the cell covers and damage SPC vessels. There are two defined outcomes as follows:

SPC-Def1: A damaging deflagration occurs in the SPC.

nSPCDef1: No damaging deflagration occurs in the SPC.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 106, 107, 108, 109, and 114. The answers to this question are used in the logic to determine the outcome probabilities in Question 116. Three cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a vessel in the SPC has been previously damaged. An overpressurization deflagration cannot occur with any of the SPC vessels damaged. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes the sequences in which a deflagratable concentration has accumulated in the SPC. The outcome probability assigned is 1.0 in Branch 1.
- Case 3 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging deflagration due to overpressurization are included in previous cases. The outcome probability assigned is 1.0 in Branch 2.

Question 116: Do the cell covers for the Salt Process Cell dislodge after the overpressurization deflagration?

The cell covers in the SPC can be dislodged and fall as a result of an overpressure deflagration event in the SPC. The falling cell covers can damage equipment and piping in the cell. There are two defined outcomes as follows:

SPCvFl@2: The cell covers dislodge and fall due to an overpressure deflagration.

nSPCovFl: The cell covers do not fall as a result of an overpressure deflagration.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 105 and 115 and are used in the logic to determine the outcome probabilities in Questions 117, 118, 119, 120, 127, 128, 129, 130, 131, 132, 133, and 134. Three cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which the cell covers were dislodged previously. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which there was an overpressurization deflagration in the SPC. An outcome probability of 1.0 is assigned Branch 1.

Case 3 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 117: Does splashing [spillage] of the Precipitate Reactor contents occur?

If the Precipitate Reactor is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the PR caused by falling cell covers after a SPC overpressurization deflagration. There are two defined outcomes as follows:

PRx-Spl2: The contents of the Precipitate Reactor are spilled into the Salt Process Cell after an overpressurization deflagration.

nPRx-Spl2: The contents of the Precipitate Reactor are not spilled into the Salt Process Cell after an overpressurization deflagration.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 106 and 116 and are used in the logic to determine the outcome probabilities in Questions 123 and 136. Three cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which the PR has been previously splashed. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which the cell covers are displaced and fall as a result of an overpressurization deflagration. The falling cell

covers can damage the PR causing spillage. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **** SAMPLED VARIABLE****

- Case 3 The default case includes all sequences remaining and assumes that all means by which the PR can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 118: Does splashing [spillage] of the contents of the Organic Evaporator tank occur?

If the OEV is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the OEV caused by falling cell covers after a SPC overpressurization deflagration. Spilling the contents of the Organic Evaporator is of concern primarily because part of the spilled benzene will evaporate and may lead to a deflagration in the Salt Process Cell. There are two defined outcomes as follows:

- OEV-Spl2: The contents of the OEV are spilled into the Salt Process Cell after an overpressurization deflagration.
- nOEV-Spl2: The contents of the OEV are not spilled into the Salt Process Cell after an overpressurization deflagration.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 107 and 116 and are used in the logic to determine the outcome probabilities in Questions 121, 122, 124, 137, and 147. Three cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the OEV has been previously splashed. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the cell covers are displaced and fall as a result of an overpressurization deflagration. The falling cell covers can damage the OEV causing spillage. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **** SAMPLED VARIABLE****
- Case 3 The default case includes all sequences remaining and assumes that all means by which the OEV can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 119: Does splashing [spillage] of the contents of the Organic Evaporator Condensate tank occur?

If the OECT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the OECT caused by falling cell covers after a SPC overpressurization deflagration. Spilling the contents of the OECT is of concern primarily because part of the spilled benzene will evaporate and may lead to a deflagration in the Salt Process Cell. There are two defined outcomes as follows:

OECT-Spl2: The contents of the OECT are spilled into the Salt Process Cell after an overpressurization deflagration.

nOECT-Spl2: The contents of the OECT are not spilled into the Salt Process Cell after an overpressurization deflagration.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 108 and 116 and are used in the logic to determine the outcome probabilities in Questions 121, 122, 125, 138, and 147. Three cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which the OECT has been previously splashed. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which the cell covers are displaced and fall as a result of an overpressurization deflagration. The falling cell covers can damage the OECT causing spillage. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **** SAMPLED VARIABLE****

Case 3 The default case includes all sequences remaining and assumes that all means by which the OECT can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 120: Does splashing [spillage] of the contents of the Precipitate Reactor Feed Tank occur?

If the PRFT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the OECT caused by falling cell covers after a SPC overpressurization deflagration. There are two defined outcomes as follows:

PRFT-Spl2: The contents of the PRFT are spilled into the Salt Process Cell after an overpressurization deflagration.

nPRFT-Spl: The contents of the PRFT are not spilled into the Salt Process Cell after an overpressurization deflagration.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 109 and 116 and are used in the logic to determine the outcome probabilities in Questions 126 and 139. Three cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which the PRFT has been previously splashed. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which the cell covers are displaced and fall as a result of an overpressurization deflagration. The falling cell covers can damage the PRFT causing spillage. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2. **** SAMPLED VARIABLE****

- Case 3 The default case includes all sequences remaining and assumes that all means by which the PRFT can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 121: Does the collateral damage in the Salt Process Cell result in a deflagration in the Salt Process Cell?

Spillage of benzene into the Salt Process Cell from the OEV or OECT could result in a deflagration. The PR and PRFT do not contain enough benzene to be of concern even if their entire contents are spilled onto the floor of the SPC. A deflagration occurring in the Salt Process Cell will be very energetic, blowing the cell covers. There are two defined outcomes as follows:

- SPC-Def2: A deflagration occurs in the Salt Process Cell.
nSPCDef2: No deflagration occurs in the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 1, 4, 107, 108, 113, 118, and 119 and are used in the logic to determine the outcome probabilities for Questions 122, 123, 124, 125, 126, 128, and 147. Fifteen cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the accident type is external, internal-energetic, or a crane load drop accident and there is no spillage from the OEV or the OECT. If there is no spillage of benzene there is no potential for a deflagration and the outcome probability is specified as 1.0 for Branch 2.
- Case 2 This case includes all sequences in which the accident type is external or internal-energetic and spillage of benzene from the OEV or the OECT after the first or second round of energetic events has occurred. The zone 1 ventilation system has failed. An outcome probability of 1.0 is assigned to Branch 1.
- Case 3 This case includes all sequences in which the accident type is external or internal-energetic and spillage of benzene from the OEV or the OECT after a SPC overpressure deflagration has occurred. Since the zone 1 ventilation system must fail for a SPC overpressure deflagration to occur, it is not explicitly asked about. An outcome probability of 1.0 is assigned to Branch 1.
- Case 4 This case includes all sequences in which the accident type is external or internal-energetic and spillage of benzene from the OEV after the first or second round of energetic events has occurred. The zone 1 ventilation system has not failed and the OEV contains hot material no more than 10% of the time. An outcome probability of 0.1 is assigned to Branch 1 and an outcome probability of 0.9 is assigned to Branch 2. ****SAMPLED VARIABLE****

- Case 5 This case includes all sequences in which the accident type is external or internal-energetic and spillage of benzene from the OECT after the first or second round of energetic events has occurred. The zone 1 ventilation system has not failed and the OECT may contain hot material although not like the OEV. An outcome probability of 0.01 is assigned to Branch 1 and an outcome probability of 0.99 is assigned to Branch 2. ****SAMPLED VARIABLE****
- Case 6 This case includes all sequences in which the accident type is a limited leak from the PR or the PRFT and the exhaust fans have failed. The PR and PRFT do not contain enough benzene to be of concern even if their entire contents are spilled onto the floor of the SPC and ventilation has failed. An outcome probability of 1.0 is assigned to Branch 2.
- Case 7 This case includes all sequences in which the accident type is a limited leak from the PR or the PRFT and the exhaust fans have not failed. An outcome probability of 1.0 is assigned to Branch 2.
- Case 8 This case includes all sequences in which the accident type is a limited leak due to an overflow from the PR or the PRFT and the exhaust fans have failed. The PR and PRFT do not contain enough benzene to be of concern even if their entire contents are spilled onto the floor of the SPC and ventilation has failed. An outcome probability of 1.0 is assigned to Branch 2.
- Case 9 This case includes all sequences in which the accident type is a limited leak due to an overflow from the PR or the PRFT and the exhaust fans have not failed. An outcome probability of 1.0 is assigned to Branch 2.
- Case 10 This case includes all sequences in which the accident type is a limited leak due to an overflow from the OEV or the OECT and the exhaust fans have failed. The likelihood of a deflagration is less likely for this case because the amount of benzene assumed to be spilled during a overflow scenario is less than the entire contents of the tanks. An outcome probability of 0.01 is assigned to Branch 1 and an outcome probability of 0.99 is assigned to Branch 2. ****SAMPLED VARIABLE****
- Case 11 This case includes all sequences in which the accident type is a limited leak due to an overflow from the OEV or the OECT and the exhaust fans have not failed. An outcome probability of 1.0 is assigned to Branch 2.
- Case 12 This case includes all sequences in which the accident type is a crane load drop which results in spillage from the OEV or the OECT and the exhaust fans have failed. An outcome probability of 0.01 is assigned to Branch 1 and an outcome probability of 0.99 is assigned to Branch 2. ****SAMPLED VARIABLE****
- Case 13 This case includes all sequences in which the accident type is a limited leak from the OEV or the OECT and the exhaust fans have failed. The likelihood of a deflagration is less likely for this case because the amount of benzene assumed to be spilled during a leak scenario is less than the amount from either the total spillage or an overflow. An outcome

probability of 0.001 is assigned to Branch 1 and an outcome probability of 0.999 is assigned to Branch 2. ****SAMPLED VARIABLE****

Case 14 This case includes all sequences in which the accident type is a limited leak from the OEV or the OECT and the exhaust fans have not failed. An outcome probability of 1.0 is assigned to Branch 2.

Case 15 The default case includes all sequences remaining. It is expected that all sequences in which a deflagration in the cell could occur are included in previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 122: Does the collateral damage in the Salt Process Cell result in a fire in the Salt Process Cell?

As indicated previously benzene may be present in any or all of the tanks in the Salt Process Cell. Spillage of this benzene into the cell could result in a fire. The PR and PRFT do not contain enough benzene to be of concern even if their entire contents are spilled onto the floor of the SPC. A fire will increase the transport of released radionuclides from the cell. There are two defined outcomes as follows:

SPC-Fire: A fire occurs in the Salt Process Cell.

nSPCFire: A fire does not occur in the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 1, 4, 107, 108, 113, 118, 119, and 121 and are used in the logic to determine the outcome probabilities for Question 147. Ten cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which there is no spillage from the OEV or the OECT. If there is no spillage of benzene there is no potential for fire and the outcome probability is specified as 1.0 for Branch 2.

Case 2 This case includes all sequences in which the accident type is external or internal-energetic, benzene has spilled from either the OEV or the OECT, and a SPC deflagration has occurred. An outcome probability of 0.9 is assigned to Branch 1 and an outcome probability of 0.1 is assigned Branch 2.
****SAMPLED VARIABLE****

Case 3 This case includes all sequences in which the accident type is external or internal-energetic, benzene has spilled from either the OEV or the OECT, and a SPC deflagration has not occurred. An outcome probability of 0.1 is assigned to Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
****SAMPLED VARIABLE****

Case 4 This case includes all sequences in which the accident type is a limited leak due to overflow from the OEV or the OECT and a SPC deflagration has occurred. An outcome probability of 0.9 is assigned to Branch 1 and an outcome probability of 0.1 is assigned Branch 2.

****SAMPLED VARIABLE****

- Case 5 This case includes all sequences in which the accident type is a limited leak due to overflow from the OEV or the OECT, a SPC deflagration has not occurred, and the Zone 1 exhaust fans have not failed (*if fans failed, and no deflagration occurs in question 121, it is implicitly assumed there is no ignition source for a fire either, if fans have not failed there may be no deflagration as is seen in case 11 of question 121 but an ignition source may still be present which could ignite a fire; this also applies to cases 7 and 9*). An outcome probability of 0.05 is assigned to Branch 1 and an outcome probability of 0.95 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 6 This case includes all sequences in which the accident type is a crane load drop, benzene has spilled from either the OEV or the OECT, and a SPC deflagration has occurred. An outcome probability of 0.9 is assigned to Branch 1 and an outcome probability of 0.1 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 7 This case includes all sequences in which the accident type is a crane load drop, benzene has spilled from the OEV or the OECT, a SPC deflagration has not occurred, and the Zone 1 exhaust fans have not failed. An outcome probability of 0.05 is assigned to Branch 1 and an outcome probability of 0.95 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 8 This case includes all sequences in which the accident type is a limited leak from the OEV or the OECT and a SPC deflagration has occurred. An outcome probability of 0.9 is assigned to Branch 1 and an outcome probability of 0.1 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 9 This case includes all sequences in which the accident type is a limited leak from the OEV or the OECT, a SPC deflagration has not occurred, and the Zone 1 exhaust fans have not failed. Since the amount of benzene spilled in a leak is less than the amount from an overflow, the chance of a fire is slightly lower for this case than for an overflow accident. An outcome probability of 0.01 is assigned to Branch 1 and an outcome probability of 0.99 is assigned Branch 2. ****SAMPLED VARIABLE****
- Case 10 The default case includes all sequences remaining. It is expected that all sequences in which a fire in the cell could occur are included in previous cases. An outcome probability of 1.0 is assigned Branch 2.

Questions 123-126 consider the possibility that another vessel has an explosive concentration built up (but no ignition source) at the same time the SPC deflagration occurs. This is the third round of tank explosions. The flame from the SPC deflagration provides the ignition source for a tank deflagration in the SPC. Since the process vessels are all cross-connected via the cell ventilation systems (SPCV, CPCV, PVVH), the vessel that deflagrates or detonates in the SPC provides an ignition source to vessels in the CPC that have an explosive concentration provided the ventilation headers are still intact. Note, for the internal energetic accidents initiated by a tank explosion, all tank explosions are complete at the end of round 2 because any tank with a

explosive concentration will have been exposed to an ignition source at that time. A "3rd round" explosion can only occur on a sequence where the SPC overpressurization deflagration (question 115) initiates a propagation leading to a second SPC deflagration thus providing an ignition source for this round of tank explosions. Propagation into the CPC is not possible because the SPC covers will have fallen and opened the SPCV preventing the flame front from further propagation. For the seismic event, propagation to the CPC is only possible if the SPC covers have not fallen prior to the SPC deflagration.

Question 123: Does a detonation/deflagration occur in the Precipitate Reactor?

If an explosive concentration occurs in the Precipitate Reactor and an ignition source is available (in this case the deflagration in the SPC), it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Precipitate Reactor can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

PRx@3Det: A damaging detonation occurs in the Precipitate Reactor following a SPC deflagration that provides an ignition source.

PRx@3Def: A damaging deflagration occurs in the Precipitate Reactor following a SPC deflagration that provides an ignition source.

nPRx-Exp: No damaging explosion occurs in the Precipitate Reactor.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 41, 43, 79, 80, 106, 117, and 121. The answers to this question are used in the logic to determine the outcome probabilities in Questions 127, 128, 136, and 137. Seven cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor. The outcome probability assigned is 1.0 in Branch 3.

Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Precipitate Reactor precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

Case 5 This case includes the sequences in which a prior energetic event has ruptured the Precipitate Reactor precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

- Case 6 This case includes the sequences in which a prior event has not occurred in the Precipitate Reactor and an explosive concentration has accumulated in the vessel with a deflagration in the SPC (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2.
- Case 7- The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 124: Does a detonation/deflagration of the Organic Evaporator tank occur?

If an explosive concentration occurs in the Organic Evaporator and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Organic Evaporator can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- OEV@3Det: A damaging detonation occurs in the Organic Evaporator following a SPC deflagration that provides an ignition source.
- OEV@3Def: A damaging deflagration occurs in the Organic Evaporator following a SPC deflagration that provides an ignition source.
- nOEV-Exp: No damaging explosion occurs in the Organic Evaporator.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 45, 47, 81, 82, 107, 118, and 121. The answers to this question are used in the logic to determine the outcome probabilities in Questions 127, 128, 136, 137, and 138. Seven cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Organic Evaporator. The outcome probability assigned is 1.0 in Branch 3.
- Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Organic Evaporator precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

- Case 5 This case includes the sequences in which a prior energetic event has ruptured the Organic Evaporator precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 6 This case includes the sequences in which a prior event has not occurred in the Organic Evaporator and an explosive concentration has accumulated in the vessel with a deflagration in the SPC (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 7 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 125: Does a detonation/deflagration of the Organic Evaporator Condensate tank occur?

If an explosive concentration occurs in the Organic Evaporator Condensate tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Organic Evaporator Condensate tank can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- OECT@3Det: A damaging detonation occurs in the Organic Evaporator Condensate tank following a SPC deflagration that provides an ignition source.
- OECT@3Def: A damaging deflagration occurs in the Organic Evaporator Condensate tank following a SPC deflagration that provides an ignition source.
- nOECT-Ex: No damaging explosion occurs in the Organic Evaporator Condensate tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 49, 51, 83, 84, 108, 119, and 121. The answers to this question are used in the logic to determine the outcome probabilities in Questions 127, 128, 137, 138, and 139. Seven cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Organic Evaporator Condensate tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Organic Evaporator Condensate tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Organic Evaporator Condensate tank. The outcome probability assigned is 1.0 in Branch 3.

- Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Organic Evaporator Condensate tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 5 This case includes the sequences in which a prior energetic event has ruptured the Organic Evaporator Condensate tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 6 This case includes the sequences in which a prior event has not occurred in the Organic Evaporator Condensate tank and an explosive concentration has accumulated in the vessel with a deflagration in the SPC (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 7 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 126: Does a detonation/deflagration occur in the Precipitate Reactor Feed Tank?

If an explosive concentration occurs in the Precipitate Reactor Feed Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Precipitate Reactor Feed Tank can spill the contents of the vessel to the Salt Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- PRFT@3Det: A damaging detonation occurs in the Precipitate Reactor Feed Tank following a SPC deflagration that provides an ignition source.
- PRFT@3Def: A damaging deflagration occurs in the Precipitate Reactor Feed Tank following a SPC deflagration that provides an ignition source.
- nPRFT-Exp: No damaging explosion occurs in the Precipitate Reactor Feed Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 53, 55, 85, 86, 109, 120, and 121. The answers to this question are used in the logic to determine the outcome probabilities in Questions 127, 128, 138, 139, and 140. Seven cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3.

- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor Feed Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Precipitate Reactor Feed Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 5 This case includes the sequences in which a prior energetic event has ruptured the Precipitate Reactor Feed Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 6 This case includes the sequences in which a prior event has not occurred in the Precipitate Reactor Feed Tank and an explosive concentration has accumulated in the vessel with a deflagration in the SPC (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 7 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 127: Does a damaging explosion occur in the Salt Process Cell Vent System [SPCV]?

Conditions in the Salt Process Cell Vent System [SPCV] are expected to be the same as the tanks exhausting into the header. Therefore an explosion in any of the SPC tanks will propagate into the header causing the header to also explode. Because of the size of the SPCV, it is expected to detonate (not deflagrate) which would produce shrapnel that could cause venting of cell tanks. There are two possible outcomes as follows:

- SPCV-Exp3: A damaging explosion occurs in the Salt Process Cell Vent System following the third round of potential explosions.
- nSPCV-Ex: A damaging explosion does not occur in the Salt Process Cell Vent System following the third round of potential explosions.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 37, 105, 116, 123, 124, 125, and 126. The answers to this question are not used in the remaining logic but are instead used in some of the output binnings. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the SPC cell covers have fallen due to a seismic event. If the cell covers fall, the SPCV piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 2 This case includes all sequences in which the SPC cell covers have fallen due to a previous energetic event. If the cell covers fall, the SPCV piping

is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.

- Case 3 This case includes all sequences in which one of the SPC vessels has detonated in the third round. A detonation in any SPC vessel is assumed to cause the SPCV to explode. (For internal energetic events, has already been destroyed and cannot explode.) An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which one of the SPC vessels has deflagrated in the third round. A deflagration in any SPC vessel is assumed to cause the SPCV to explode. (For internal energetic events, has already been destroyed and cannot explode.) An outcome probability of 1.0 is assigned Branch 1.
- Case 5 The default case includes all sequences remaining and assumes that there is no other mechanism for an explosion in the SPCV. An outcome probability of 1.0 is assigned Branch 2.

Question 128: Do the cell covers for the Salt Process Cell dislodge and fall?

The cell covers in the SPC can be dislodged and fall as a result of an energetic event in the SPC. The falling cell covers can damage equipment and piping in the cell. This will only occur for a seismic event where the cell covers have not already fallen. There are two defined outcomes as follows:

- SPCvFl@3: The cell covers dislodge and fall due to an energetic event in the third round of explosions.
- nSPCovFl: The cell covers do not fall as a result of an energetic event in the third round of explosions.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 37, 105, 116, 121, 123, 124, 125, 126, and 127 and are used in the logic to determine the outcome probabilities in Questions 136, 137, 138, and 139. Six cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the cell covers were dislodged previously. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was no explosion in any SPC vessel, the SPCV did not explode, the cell covers did not fall due to a seismic event, and no SPC deflagration occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which there was a deflagration in the SPC. An outcome probability of 1.0 is assigned Branch 1.

- Case 4 -- This case includes all sequences in which there was a detonation in any SPC vessel during the third round of explosions. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 This case includes all sequences in which there was a deflagration in any SPC vessel during the third round of explosions. An outcome probability of 1.0 is assigned Branch 1.
- Case 6 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 129: Does a damaging detonation occur in the Process Vessel Vent Header [PVVH]?

The PVVH is assumed to explode if an explosion occurs in one of the headers that connect to it (SPCV or CPCV). Therefore, if Question 127 indicates that an explosion occurred in the SPCV then a detonation in the PVVH will follow. A detonation in the PVVH can cause cell covers in the Chemical Process Cell to fall. There are two defined outcomes as follows:

- PVVH-DT2: A damaging detonation occurs in the Process Vessel Vent Header following the third round of explosions.
- nPVVH-Ex: No damaging explosion occurs in the Process Vessel Vent Header.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 56, 105, 116, and 127. The answers to this question are used in the logic to determine the outcome probabilities in Questions 130, 131, 132, 133, and 141. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the CPC cell covers have fallen due to a seismic event. If the cell covers fall, the PVVH piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 2 This case includes all sequences in which the SPC cell covers were dislodged previously. If the SPC cell covers were dislodged previously, the SPCV piping is assumed to be damaged to the point that it would be unable to transmit an explosion to the PVVH. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which a damaging detonation has occurred in the SPCV after the third round of explosions. The outcome probability assigned is 1.0 in Branch 1.
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 2.

Question 130: Does a detonation/deflagration occur in the Precipitate Reactor Bottoms Tank [PRBT]?

If an explosive concentration occurs in the Precipitate Reactor Bottoms Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Precipitate Reactor Bottoms Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

PRBT@3Det: A damaging detonation occurs in the Precipitate Reactor Bottoms Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.

PRBT@3Def: A damaging deflagration occurs in the Precipitate Reactor Bottoms Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.

nPRBT-Ex: No damaging explosion occurs in the Precipitate Reactor Bottoms Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 58, 60, 87, 88, 99, 105, 116, and 129. The answers to this question are used in the logic to determine the outcome probabilities in Questions 134, 135, 141, 142, and 143. Eight cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a previous detonation occurred in the Precipitate Reactor Bottoms Tank. The outcome probability assigned is 1.0 in Branch 3.

Case 2 This case includes all sequences in which a previous deflagration occurred in the Precipitate Reactor Bottoms Tank. The outcome probability assigned is 1.0 in Branch 3.

Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Precipitate Reactor Bottoms Tank. The outcome probability assigned is 1.0 in Branch 3.

Case 4 This case includes the sequences in which a seismic event or crane drop accident has ruptured the Precipitate Reactor Bottoms Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

Case 5 This case includes all sequences in which the PRBT has been splashed as a result of a prior energetic event. Splashing of the tank precludes the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

Case 6 This case includes all sequences in which the SPC cell covers have previously fallen. If the cell covers have fallen there is no path to conduct the ignition source from the SPC to the CPC. As a result, no explosion can occur. The outcome probability assigned is 1.0 in Branch 3.

- Case 7 This case includes the sequences in which a prior event has not occurred in the Precipitate Reactor Bottoms Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 8 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 131: Does a detonation/deflagration occur in the Slurry Mix Evaporator Tank [SME]?

If an explosive concentration occurs in the Slurry Mix Evaporator Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Slurry Mix Evaporator Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- SME@3Det: A damaging detonation occurs in the Slurry Mix Evaporator Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.
- SME@3Def: A damaging deflagration occurs in the Slurry Mix Evaporator Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.
- nSME-Ex: No damaging explosion occurs in the Slurry Mix Evaporator Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 62, 64, 89, 90, 100, 105, 116, and 129. The answers to this question are used in the logic to determine the outcome probabilities in Questions 134, 141, 142, and 143. Eight cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Slurry Mix Evaporator Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Slurry Mix Evaporator Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Slurry Mix Evaporator Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Slurry Mix Evaporator Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

- Case 5 This case includes all sequences in which the SPC cell covers have previously fallen. If the cell covers have fallen there is no path to conduct the ignition source from the SPC to the CPC. As a result, no explosion can occur. The outcome probability assigned is 1.0 in Branch 3.
- Case 6 This case includes all sequences in which the SME has been splashed as a result of a prior energetic event. Splashing of the tank precludes the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 7 This case includes the sequences in which a prior event has not occurred in the Slurry Mix Evaporator Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 8 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 132: Does a detonation/deflagration occur in the Sludge Receipt and Adjustment Tank [SRAT]?

If an explosive concentration occurs in the Sludge Receipt Adjustment Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Sludge Receipt Adjustment Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

- SRAT@3Det: A damaging detonation occurs in the Sludge Receipt Adjustment Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.
- SRAT@3Def: A damaging deflagration occurs in the Sludge Receipt Adjustment Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.
- nSRAT-Ex: No damaging explosion occurs in the Sludge Receipt Adjustment Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 66, 68, 91, 92, 101, 105, 116, and 129. The answers to this question are used in the logic to determine the outcome probabilities in Questions 134, 141, 144, and 145. Eight cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Sludge Receipt Adjustment Tank. The outcome probability assigned is 1.0 in Branch 3.

- Case 2 This case includes all sequences in which a previous deflagration occurred in the Sludge Receipt Adjustment Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Sludge Receipt Adjustment Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Sludge Receipt Adjustment Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 5 This case includes all sequences in which the SRAT has been splashed as a result of a prior energetic event. Splashing of the tank precludes the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 6 This case includes all sequences in which the SPC cell covers have previously fallen. If the cell covers have fallen there is no path to conduct the ignition source from the SPC to the CPC. As a result, no explosion can occur. The outcome probability assigned is 1.0 in Branch 3.
- Case 7 This case includes the sequences in which a prior event has not occurred in the Sludge Receipt Adjustment Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 8 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 133: Does a detonation/deflagration occur in the Melter Feed Tank [MFT]?

If an explosive concentration occurs in the Melter Feed Tank and an ignition source is available it is assumed that a damaging detonation or deflagration will follow. A detonation/deflagration in the Melter Feed Tank can spill the contents of the vessel to the Chemical Process Cell, blow the cell covers, and damage adjacent vessels. There are three defined outcomes as follows:

MFT@3Det: A damaging detonation occurs in the Melter Feed Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.

MFT@3Def: A damaging deflagration occurs in the Melter Feed Tank following a detonation or deflagration in another process vessel during the third round of explosions that provides an ignition source.

nMFT-Ex: No damaging explosion occurs in the Melter Feed Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 72, 74, 93, 94, 103, 105, 116, and 129. The answers to this question are used in the logic to determine the outcome probabilities in Questions 134, 141, 145, and 146. Eight cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which a previous detonation occurred in the Melter Feed Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes all sequences in which a previous deflagration occurred in the Melter Feed Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 This case includes all sequences in which an explosive concentration does not accumulate in the Melter Feed Tank. The outcome probability assigned is 1.0 in Branch 3.
- Case 4 This case includes the sequences in which a seismic event or crane load drop accident has ruptured the Melter Feed Tank precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 5 This case includes all sequences in which the MFT has been splashed as a result of a prior energetic event. Splashing of the tank precludes the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 6 This case includes all sequences in which the SPC cell covers have previously fallen. If the cell covers have fallen there is no path to conduct the ignition source from the SPC to the CPC. As a result, no explosion can occur. The outcome probability assigned is 1.0 in Branch 3.
- Case 7 This case includes the sequences in which a prior event has not occurred in the Melter Feed Tank and an explosive concentration has accumulated in the vessel with a detonation in the PVVH (provides the ignition source). The outcome probability assigned is 0.001 in Branch 1 and 0.999 in Branch 2 [7].
- Case 8 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 134: Does a detonation occur in the CPC Vent system?

An explosion in the CPCV can cause spillage of the contents of some of the tanks in the CPC due to lifting of the cell covers. There are two defined outcomes as follows:

- CPCV-Exp1: A damaging explosion occurs in the Chemical Process Cell Vent System following the third round of potential explosions.

nCPCV-Ex: No damaging explosion occurs in the Chemical Process Cell Vent System following the third round of potential explosions.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 98, 105, 116, 130, 131, 132, and 133. The answers to this question are used in the logic to determine the outcome probabilities in Question 141. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the CPC cell covers have previously fallen. If the cell covers fall, the CPCV piping is assumed to be damaged to the point that no accumulation of explosive mixtures is possible. An outcome probability of 1.0 is assigned to Branch 2.
- Case 2 This case includes all sequences in which the SPC cell covers have previously fallen. If the cell covers have fallen there is no path to conduct the ignition source from the SPC to the CPC. As a result, no explosion can occur. The outcome probability assigned is 1.0 in Branch 2.
- Case 3 This case includes all sequences in which one of the CPC vessels has detonated or deflagrated in the third round. A detonation in any CPC vessel is assumed to cause the CPCV to explode. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that there is no other mechanism for an explosion in the CPCV. An outcome probability of 1.0 is assigned Branch 2.

Question 135: Does an energetic event in the CPC fail the removable wall between the SPC and the CPC?

The Salt Process Cell and the Chemical Process Cell are separated by a removable [from above] partition. Some events in the CPC are assumed to be sufficiently energetic to displace the partition from its supports, causing damage to the tanks, piping, etc. in the SPC. There are two defined outcomes as follows:

- FailWall2: The wall separating the Salt Process Cell and the Chemical Process Cell is failed due to an energetic event in the third round of explosions.
- nFailWal: The wall separating the Salt Process Cell and the Chemical Process Cell is not failed.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 97, 104, and 130 and are used in the logic to determine the outcome probabilities for Questions 136, 137, 138, and 139. Three cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which the removable wall has been failed in a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.

- Case 2 This case includes all sequences in which a detonation has occurred in the PRBT during the third round of explosions. An outcome probability of 0.5 is assigned to Branch 1 and Branch 2 [7].
- Case 3 The default case includes all sequences remaining. It is expected that all sequences in which the wall could be failed are included in previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 136: Does splashing [spillage] of the Precipitate Reactor contents occur?

If the Precipitate Reactor is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the PR caused by falling cell covers, a detonation in the PR during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

- PRx-Spl3: The contents of the Precipitate Reactor are spilled into the Salt Process Cell after an energetic event during the third round of explosions.
- nPRx-Spl: The contents of the Precipitate Reactor are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 41, 106, 117, 123, 124, 128, and 135. The answers to this question are used in the source term biner. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the PR has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the PR has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which no event that could damage the PR has occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there was a detonation of the Precipitate Reactor during the third round of explosions. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the OEV, which is adjacent to the PR, during the third round of explosions. The falling cell covers or shrapnel from the exploding OEV can penetrate the PR causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the OEV, which is adjacent to the PR,

during the third round of explosions. The falling cell covers or shrapnel from the vent piping above the deflagrating OEV can penetrate the PR causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.

Case 7 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.

Case 8 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The PR is separated from this wall by three other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.

Case 9 The default case includes all sequences remaining and assumes that all means by which the PR can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 137: Does splashing [spillage] of the contents of the Organic Evaporator tank occur?

If the OEV is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the OEV caused by falling cell covers, a detonation in the OEV during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

OEV-Spl3: The contents of the OEV are spilled into the Salt Process Cell after an energetic event during the third round of explosions.

nOEV-Spl: The contents of the OEV are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 45, 107, 118, 123, 124, 125, 128, and 135. The answers to this question are used in the source term biner. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which the OEV has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which the OEV has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.

Case 3 This case includes all sequences in which no event that could damage the OEV has occurred. An outcome probability of 1.0 is assigned Branch 2.

Case 4 This case includes all sequences in which there was a detonation of the OEV during the third round of explosions. An outcome probability of 1.0 is assigned Branch 1.

- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the PR or OECT which are adjacent to the OEV. The falling cell covers or shrapnel from the exploding PR or OECT can penetrate the OEV causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the PR or OECT which are adjacent to the OEV. The falling cell covers or shrapnel from the vent piping above the deflagrating PR or OECT can penetrate the OEV causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
- Case 7 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 8 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The OEV is separated from this wall by two other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 9 The default case includes all sequences remaining and assumes that all means by which the OEV can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 138: Does splashing [spillage] of the contents of the Organic Evaporator Condensate tank occur?

If the OECT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the OECT caused by falling cell covers, a detonation in the OECT during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

- OECT-Spl3: The contents of the OECT are spilled into the Salt Process Cell after an energetic event during the third round of explosions.
- nOECT-Spl: The contents of the OECT are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 49, 108, 119, 124, 125, 126, 128, and 135. The answers to this question are used in the source term biner. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the OECT has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.

- Case 2 This case includes all sequences in which the OECT has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which no event that could damage the OECT has occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there was a detonation of the OECT during the third round of explosions. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the PRFT or OEV which are adjacent to the OECT. The falling cell covers or shrapnel from the exploding PRFT or OEV can penetrate the OECT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the PRFT or OEV which are adjacent to the OECT. The falling cell covers or shrapnel from the vent piping above the deflagrating PRFT or OEV can penetrate the OECT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
- Case 7 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 8 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The OECT is separated from this wall by one other tank. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 9 The default case includes all sequences remaining and assumes that all means by which the OECT can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 139: Does splashing [spillage] of the contents of the Precipitate Reactor Feed Tank occur?

If the Precipitate Reactor Feed Tank is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the PRFT caused by falling cell covers, a detonation in the PRFT during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

- PRFT-Spl3: The contents of the PRFT are spilled into the Salt Process Cell after an energetic event during the third round of explosions.
- nPRFT-Spl: The contents of the PRFT are not spilled into the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 53, 109, 120, 125, 126, 128, and 135. The answers to this question are used in the source term biner. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the PRFT has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the PRFT has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which no event that could damage the PRFT has occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there was a detonation of the PRFT during the third round of explosions. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the SPC. The PRFT is adjacent to this wall. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the OECT which is adjacent to the PRFT. The falling cell covers or shrapnel from the exploding OECT can penetrate the PRFT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 7 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the OECT which is adjacent to the PRFT. The falling cell covers or shrapnel from the vent piping above the deflagrating OECT can penetrate the PRFT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
- Case 8 This case includes all sequences in which the cell covers are dislodged and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 9 The default case includes all sequences remaining and assumes that all means by which the PRFT can be damaged have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 140: Does an energetic event in the SPC fail the removable wall between the SPC and the CPC?

The Salt Process Cell and the Chemical Process Cell are separated by a removable [from above] partition. Some events in the SPC are assumed to be sufficiently energetic to displace

the partition from its supports, causing damage to the tanks, piping, etc. in the CPC. There are two defined outcomes as follows:

- FailWall:** The wall separating the Salt Process Cell and the Chemical Process Cell is failed due to an energetic event in the third round of explosions.
- nFailWal:** The wall separating the Salt Process Cell and the Chemical Process Cell is not failed due to an energetic event in the third round of explosions.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 97, 104, and 126 and are used in the logic to determine the outcome probabilities for Questions 142, 143, 144, 145, and 146. Three cases are used to develop the outcome probabilities as follows:

- Case 1** This case includes all sequences in which the removable wall has been failed in a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2** This case includes all sequences in which a detonation has occurred in the PRFT during the third round of explosions. An outcome probability of 0.5 is assigned to Branch 1 and Branch 2 [7].
- Case 3** The default case includes all sequences remaining. It is expected that all sequences in which the wall could be failed are included in previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 141: Do the cell covers for the Chemical Process Cell dislodge and fall following an energetic event?

The cell covers in the CPC can be dislodged and fall as a result of an energetic event in the CPC. The falling cell covers can damage equipment and piping in the cell. There are two defined outcomes as follows:

- CPCovFl@2:** The cell covers in the Chemical Process Cell dislodge and fall due to an energetic event during the third round of explosions.
- nCPCovFl:** The cell covers in the Chemical Process Cell do not dislodge and fall due to an energetic event during the third round of explosions.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 56, 98, 129, 130, 131, 132, 133, and 134. The answers to this question are used in the logic to determine the outcome probabilities in Questions 142, 143, 144, 145, and 146. Four cases are used to develop the outcome probabilities as follows:

- Case 1** This case includes all sequences in which a previous event has caused the cell covers to be dislodged. An outcome probability of 1.0 is assigned Branch 2.

- Case 2 This case includes all sequences in which no energetic event has occurred in the CPC and a seismic event has not dislodged the cell covers. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which a detonation or deflagration has occurred in a CPC vessel or piping during the third round of energetic events. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 142: Does splashing [spillage] of the Precipitate Reactor Bottoms Tank contents occur?

If the PRBT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the PRBT caused by falling cell covers, a detonation in the PRBT during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

- PRBT-Spl2: The contents of the Precipitate Reactor Bottoms Tank are spilled into the Chemical Process Cell after an energetic event during the third round of explosions.
- nPRBT-Spl: The contents of the Precipitate Reactor Bottoms Tank are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 58, 99, 130, 131, 140, and 141. The answers to this question are used in the source term biner. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the PRBT has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the PRBT has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which no event that could damage the PRBT has occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there is a detonation in the Precipitate Reactor Bottoms Tank during the third round of explosions. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.

- Case 5 This case includes all sequences in which the removable wall between the CPC and the SPC has failed. Spillage of the tank contents is possible. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and there is a detonation of the Slurry Mix Evaporator, which is adjacent to the PRBT. The falling cell covers or shrapnel from the detonating SME can penetrate the PRBT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 7 This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration of the Slurry Mix Evaporator, which is adjacent to the PRBT. The falling cell covers or shrapnel from the vent piping above the deflagrating SME can penetrate the PRBT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
- Case 8 This case includes all sequences in which the cell covers are displaced and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 9 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the Precipitate Reactor Bottoms Tank can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 143: Does splashing [spillage] of the Slurry Mix Evaporator Tank contents occur?

If the SME is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the SME caused by falling cell covers, a detonation in the SME during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

- SME-Spl2: The contents of the Slurry Mix Evaporator are spilled into the Chemical Process Cell after an energetic event during the third round of explosions.
- nSME-Spl: The contents of the Slurry Mix Evaporator are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 62, 100, 130, 131, 140, and 141. The answers to this question are used in the source term biner. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the SME has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.

- Case 2 This case includes all sequences in which the SME has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which no event that could damage the SME has occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there is a detonation of the Slurry Mix Evaporator during the third round of explosions. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 This case includes all sequences in which the cell covers are displaced and fall and a detonation occurs in the Precipitate Reactor Bottoms Tank, which is adjacent to the SME. The falling cell covers or shrapnel from the exploding PRBT can penetrate the SME causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
- Case 6 This case includes all sequences in which the cell covers are displaced and fall and a deflagration occurs in the Precipitate Reactor Bottoms Tank, which is adjacent to the SME. The falling cell covers or shrapnel from the vent piping above the deflagrating PRBT can penetrate the SME causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
- Case 7 This case includes all sequences in which the cell covers are displaced and fall. The falling cell covers can damage the SME. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 8 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The SME is separated from this wall by the PRBT. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 9 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the Slurry Mix Evaporator can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 144: Does splashing [spillage] of the Sludge Receipt and Adjustment Tank contents occur?

If the SRAT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the SRAT caused by falling cell covers, a detonation in the SRAT during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. There are two defined outcomes as follows:

- SRAT-Spl2: The contents of the SRAT are spilled into the Chemical Process Cell after an energetic event during the third round of explosions.

nSRAT-Spl: The contents of the SRAT are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 66, 101, 132, 140, and 141. The answers to this question are used in the source term biner. Seven cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

- Case 1 This case includes all sequences in which the SRAT has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the SRAT has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which no event that could damage the SRAT has occurred. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there is a detonation in the SRAT during the third round of explosions. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 This case includes all sequences in which the cell covers are displaced and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 6 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The SRAT is separated from this wall by three other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
- Case 7 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the SRAT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 145: Does splashing [spillage] of the Recycle Collection Tank contents occur?

If the RCT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the RCT caused by falling cell covers, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC or shrapnel from an adjacent tank generated during the third round of explosions. There are two defined outcomes as follows:

RCT-Spl2: The contents of the RCT are spilled into the Chemical Process Cell after an energetic event during the third round of explosions.

nRCT-Spl: The contents of the RCT are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 70, 102, 132, 133, 140, and 141. The answers to this question are used in the source term biner. Eight cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1	This case includes all sequences in which the RCT has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.
Case 2	This case includes all sequences in which the RCT has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.
Case 3	This case includes all sequences in which no event that could damage the RCT has occurred. An outcome probability of 1.0 is assigned Branch 2.
Case 4	This case includes all sequences in which the cell covers are displaced and fall and there is a detonation in the MFT or the SRAT, which are adjacent to the RCT. The falling cell covers or shrapnel from the exploding MFT or SRAT can penetrate the RCT causing spillage. An outcome probability of 0.5 is assigned Branch 1 and Branch 2.
Case 5	This case includes all sequences in which the cell covers are displaced and fall and there is a deflagration in the MFT or the SRAT, which are adjacent to the RCT. The falling cell covers or shrapnel from the vent piping above the deflagrating MFT or SRAT can penetrate the RCT causing spillage. An outcome probability of 0.2 is assigned Branch 1 and an outcome probability of 0.8 is assigned Branch 2.
Case 6	This case includes all sequences in which the cell covers are displaced and fall. The falling cell covers can damage the RCT. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
Case 7	This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The RCT is separated from this wall by four other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.
Case 8	The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the RCT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 146: Does splashing [spillage] of the Melter Feed Tank contents occur?

If the MFT is damaged some or all of the contents of the tank may be spilled to the floor. This question is concerned only with damage to the MFT caused by falling cell covers, a detonation in the MFT during the third round of explosions, shrapnel from an adjacent tank generated during the third round of explosions or failure of the wall between the CPC and SPC. or

shrapnel from an adjacent tank generated during the third round of explosions. There are two defined outcomes as follows:

MFT-Spl2: The contents of the MFT are spilled into the Chemical Process Cell after an energetic event during the third round of explosions.

nMFT-Spl: The contents of the MFT are not spilled into the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 72, 103, 133, and 141. The answers to this question are used in the source term biner. Seven cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 7):

Case 1 This case includes all sequences in which the MFT has been previously ruptured by a seismic event or crane load drop accident. An outcome probability of 1.0 is assigned Branch 2.

Case 2 This case includes all sequences in which the MFT has been splashed by a previous energetic event. An outcome probability of 1.0 is assigned Branch 2.

Case 3 This case includes all sequences in which no event that could damage the MFT has occurred. An outcome probability of 1.0 is assigned Branch 2.

Case 4 This case includes all sequences in which there is a detonation in the MFT during the third round of explosions. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.

Case 5 This case includes all sequences in which the cell covers are displaced and fall. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.

Case 6 This case includes all sequences in which the wall separating the SPC and the CPC is displaced into the CPC. The MFT is separated from this wall by five other tanks. An outcome probability of 0.1 is assigned Branch 1 and an outcome probability of 0.9 is assigned Branch 2.

Case 7 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the MFT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 147: Does a deflagration in the SPC lead to a deflagration in the RPC that damages the building?

A deflagration that occurs in the SPC due to spillage of large quantities of benzene from the OEV or OECT will blow the cell covers that separate the SPC from the Remote Process Cell (RPC). If the SPC deflagration is not followed by a fire that consumes the remainder of the benzene, it is possible for benzene vapors to migrate from the SPC to the RPC in sufficient quantity to reach LFL in the RPC. If an ignition source subsequently ignites these vapors, the resulting deflagration is assumed to cause severe damage to the vitrification building. For

source term calculations, as a result of a RPC deflagration and the resultant building damage, all of the tanks in the building are assumed to have their contents spilled. There are two defined outcomes as follows:

VB-Clpse2: The Vitrification Building is damaged by a RPC deflagration.

nVB-Clps2: The Vitrification Building is not damaged by a RPC deflagration.

This is a Type 2 question. The answers to this question are dependent on the outcomes of Questions 1, 107, 108, 110, 118, 119, 121, and 122. The answers to this question are used in the source term biner. Three cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which the Vitrification Building has been collapsed by a seismic event. The outcome probability is specified as 1.0 for Branch 2.

Case 2 This case includes all sequences in which the accident type is external or internal-energetic, the OEV or OECT have been splashed, and a SPC deflagration without a fire has occurred. An outcome probability of 0.9 is assigned to Branch 1 and an outcome probability of 0.1 is assigned to Branch 2 [7]. ****SAMPLED VARIABLE****

Case 3 The default case includes all sequences remaining. It is expected that all sequences in which the vitrification building could be breached are included in previous cases. An outcome probability of 1.0 is assigned to Branch 2.

Question 148: Do the cell covers over the Melter Cell dislodge and fall because of a seismic event?

The process cells within the main canyon of the DWPF are 'roofed' by removable steel covers. These covers provide limited isolation of the cell in the event of an in-cell release, assist in maintaining proper ventilation flow, and protect the equipment within the cell from falling objects. However, if the cell covers are dislodged and fall into the cell, either through a seismic event or an energetic event within the cell, they may damage the equipment in the cell. This question examines the impact of a seismic event on the covers for the Melter Cell. There are two possible outcomes as follows:

fMCvSeis: The Melter Cell covers are dislodged by the Seismic event and fall into the cell.

nfMCvSei: The Melter Cell covers remain in place following the Seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2 and the value specified for the parameter CCovFr, the seismic fragility of the covers for the Salt and Chemical Process Cells and the Melter Cells. The answers to this question are used in the logic to determine the outcome probabilities in Questions 149 and 156. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the initiating event is a seismic event. The seismic fragility of the covers for the Melter Cell [the

probability the cell covers will fall] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the cell covers do not fall.

Question 149: Do the cell covers that fall in a seismic event strike the Melter?

Falling cell covers during a seismic event can rupture and spill the contents of the Melter. There are two possible outcomes as follows:

MCv-Melt: The Melt Cell Covers are dislodged by the Seismic event and fall on the Melter.

nMCv-Mel: The Melt Cell Covers do not fall on the Melter.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 148. The answers to this question are used in the logic to determine the outcome probabilities in Question 150 and 151. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes those sequences in which the initiating event is a seismic event and the Melt Cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.01, the outcome probability for Branch 2 is 0.99 [7].

Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 150: Does a Seismic event rupture and spill the contents of the Melter in the Melter Cell?

Falling cell covers during a seismic event can rupture and spill the contents of the Melter. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

RptMelt: The Melter is ruptured and the contents spilled as a result of the seismic event.

nRptMelt: The Melter is intact following the seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Questions 2, 148, and 149 and the value specified for the parameter MeltFr, the seismic fragility of the Melter. The answers to this question are used in the logic to determine the outcome probabilities in Questions 153, 155, and 157. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event has caused the cell covers over the Melter Cell to fall and strike the Melter. The falling

cell covers are assumed to rupture and spill the contents of the Melter. An outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or if they fall they do not strike the Melter. The seismic fragility of the Melter [the probability that a seismic event will cause a structural failure of the Melter] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 151: Does a Seismic event rupture the Melter Offgas System in the Melter Cell?

Falling cell covers during a seismic event can rupture the Melter Offgas system. Shaking during a seismic event can also damage the Melter Offgas system. There are two defined outcomes to this question as follows:

RptMog: The Melter Offgas System is ruptured as a result of the seismic event.

nRptMog: The Melter Offgas System is intact following the seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Questions 2, 148, and 149 and the value specified for the parameter **MOG_Fr**, the seismic fragility of the Melter Offgas System. The answers to this question are used in the logic to determine the outcome probabilities in Questions 153 and 157. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event has caused the cell covers over the Melter Cell to fall and strike the Melter Offgas System. The falling cell covers are assumed to rupture the Melter Offgas System. An outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall. The seismic fragility of the Melter Offgas System is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 152: Does an explosive concentration exist in the Melter Offgas System?

Chemical reactions in the Melter produce combustible gases including hydrogen and carbon monoxide. The melter vapor space is maintained above 650°C by four groups of heaters in the dome of the Melter. This temperature assures that the combustible gases burn as produced

rather than accumulating to an explosive concentration. The two outcomes defined for this question are as follows:

- Con-MOG: An explosive concentration accumulates in the Melter Offgas System.
- nConMOG: An explosive concentration does not accumulate in the Melter Offgas System.

This is a Type 6 question and uses previously quantified parameters [62, 70, 71, 90, 93, and 103] and a user defined function to determine the probability that an explosive concentration will occur in the MOG. The user function includes information from solution of the fault tree for a MOG explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 153.

The following case structure is simplified by not considering the possibility of prior rupture of the Melter or Melter Offgas System during a seismic event. Rupture of the Melter or Melter Offgas System would prevent the buildup of an explosive concentration in the MOG. The possibility of prior rupture of the Melter or Melter Offgas System is included in Question 153. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes all sequences in which the accident class is internal-energetic and the normal power system has failed. Failure of normal power stops the melter process and precludes the formation of an explosive concentration. An outcome probability of 1.0 is assigned Branch 2.
- Case 3 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-OGAS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-OGASS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 5 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 3 and 4. An outcome probability of 1.0 is assigned Branch 2.

Question 153: Does a damaging detonation occur in the Melter Offgas System?

If an explosive concentration occurs in the Melter Offgas System and an ignition source is available it is assumed that a damaging explosion will follow. The fault tree for the MOG explosion includes the probability of an ignition source. Therefore, if Question 152 indicates

that an explosive concentration is available then an explosion will follow. An explosion in the Melter Offgas System can release the contents of the Melter Offgas into the Melter Cell. There are two defined outcomes as follows:

MOG-Det: A damaging detonation occurs in the Melter Offgas System.

nMOG-Ex: No damaging detonation occurs in the Melter Offgas System.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 150, 151, and 152. The answers to this question are used in the logic to determine the outcome probabilities in Questions 156 and 157. Five cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the MOG. The outcome probability assigned is 1.0 in Branch 2.

Case 2 This case includes the sequences in which a prior event has ruptured the Melter, therefore, venting the offgas system and precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 2.

Case 3 This case includes all sequences in which the Melter Offgas System has been ruptured, precluding the accumulation of an explosive concentration. An outcome probability of 1.0 is assigned Branch 2.

Case 4 This case includes the sequences in which a prior event has not ruptured the MOG and an explosive concentration has accumulated in the system. The outcome probability assigned is 1.0 in Branch 1.

Case 5 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 2.

Question 154: Does a damaging steam explosion occur due to a salt/water reaction in the Melter?

Conditions that could lead to a steam explosion in the melter require the presence of both water and partially melted excess salt. A fault tree was constructed to calculate the frequency of steam explosions in the Melter due to a salt/water reaction [5]. There are no major support systems modeled in the Melter steam explosion fault tree. The events in the tree include only human errors and failures of sampling equipment used to verify the salt content of each melter batch. The solution of this fault tree (cut sets) is used to determine the frequency of a steam explosion in the Melter due to a salt/water reaction. Such an explosion could damage the Melter and spill the contents or release melter offgas into the Melter Cell. The two outcomes defined for this question are as follows:

Con-MEL: A damaging salt/water reaction takes place in the Melter.

nConMEL: A damaging salt/water reaction does not take place in the Melter.

This is a Type 6 question and uses previously quantified parameters [70, 71, 90] and a user defined function to determine the probability that an salt/water reaction will occur in the Melter. The user function includes information from solution of the fault tree for the Melter salt/water reaction. The function used to calculate the answer depends on the answer to previous Question 1. The answers to this question are used in the logic to determine the outcome probabilities in Question 155. Four cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1	This case includes all sequences in which the accident type is not external or internal-energetic. A salt/water reaction cannot happen for the other accident types. An outcome probability of 1.0 is assigned Branch 2.
Case 2	This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-SMEL and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
Case 3	This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-SMELS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1
Case 4	The default case includes all remaining sequences. It is expected that all sequences that would result in a steam explosion have been identified in the previous cases. The outcome probability assigned is 1.0 in Branch 2.

Question 155: Does a damaging reaction occur in the Melter?

The fault tree for the Melter Explosion includes all factors necessary for a salt/water reaction to occur. Therefore, if Question 154 indicates that an reaction occurs, then a steam explosion will follow. A steam explosion in the Melter can spill the contents of the vessel, damage the Melter Offgas system, and blow the cell covers. There are two defined outcomes as follows:

MEL-Exp: A damaging steam explosion occurs in the Melter.

nMEL-Ex: No damaging explosion occurs in the Melter.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 150 and 154. The answers to this question are used in the logic to determine the outcome probabilities in Questions 156 and 157. Four cases are used to develop the outcome probabilities as follows:

Case 1	This case includes all sequences in which an salt/water reaction does not take place in the Melter. The outcome probability assigned is 1.0 in Branch 2.
Case 2	This case includes the sequences in which a prior event has ruptured the Melter precluding a steam explosion. The outcome probability assigned is 1.0 in Branch 2.

- Case 3 This case includes the sequences in which a prior event has not ruptured the Melter and a salt/water reaction has taken place in the vessel. The outcome probability assigned is 1.0 in Branch 1.
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 2.

Question 156: Do the cell covers for the Melter Cell dislodge and fall following an energetic event?

The previous Question 148 determined the impact of a seismic event on the cell covers. If a seismic event has not occurred it is assumed that the cell covers are in place prior to any in-cell energetic event. If a seismic event has occurred then the cell covers may have been dislodged. The assumed effect of dislodged cell covers on the tanks and equipment in the cell is essentially the same, whether dislodged by a seismic event or an in-cell explosion. Falling cell covers can rupture and spill the contents of the Melter or damage the Melter Offgas System. There are two defined outcomes as follows:

- MCovFal: The cell covers in the Melter Cell dislodge and fall, either the consequence of a seismic event or an in-cell explosion.
- nMCovFal: The cell covers in the Melter Cell are in place.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 2, 148, 153, and 155. The answers to this question are used in the logic to determine the outcome probabilities in Question 157. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there is no explosion in the Melter Offgas System, no explosion in the Melter, and no Seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the cell covers were dislodged by a seismic event. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is an explosion in the Melter Offgas System. The explosions are not sufficiently energetic to dislodge the cell covers [13]. An outcome probability of 1.0 is assigned Branch 2.
- Case 4 This case includes all sequences in which there is an explosion in the Melter. It is assumed that these explosions are sufficiently energetic to dislodge the cell covers. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 157: Does splashing [spillage] of the Melter contents occur as the result of energetic events in the Melter Cell?

If the Melter or the Melter Offgas System is damaged some or all of the contents of the Melter may be spilled to the floor and/or the offgases released to the cell. Damage to the Melter can be caused by falling cell covers (including crane drops), by shaking during a Seismic event and by an explosion associated with the Melter. Spilling the contents of the Melter is of concern primarily because the contents are radioactive. Failure of the Offgas System may release combustible gases and volatilized radioactive material to the cell. There are four defined outcomes as follows:

- tMSpl/OG: All of the contents of the Melter and the Melter Offgas System are released to the Melter Cell.
- pMSpl/OG: Part of the contents of the Melter and the Melter Offgas System are released to the Melter Cell.
- Mlt-OG: The Melter Offgas System is damaged and its contents released to the Melter Cell.
- nMltRlse: There is no release of material from the Melter or the Melter Offgas System.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1, 2, 4, 5, 39, 150, 151, 153, 155, and 156. The answers are not used in the logic to determine the outcome probabilities in other questions but are used in the source term binning file. Nine cases are used to develop the outcome probabilities as follows (The outcome probabilities are from Reference 9):

- Case 1 This case includes all sequences in which there is a limited leak in the Melter. Some spillage of the tank contents will occur. An outcome probability of 0.01 is assigned Branch 2; an outcome probability of 0.99 is assigned Branch 3. ****SAMPLED VARIABLE****
- Case 2 This case includes all sequences in which there was a seismic initiated rupture of the Melter, either from falling cell covers or from shaking. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was a seismic initiated rupture of the Melter Offgas System, either from falling cell covers or from shaking. An outcome probability of 1.0 is assigned Branch 3.
- Case 4 This case includes all sequences in which the covers of the Melter Cell fall from an energetic event in the cell. An outcome probability of 0.01 is assigned Branch 2 and an outcome probability of 0.99 is assigned Branch 3. ****SAMPLED VARIABLE****
- Case 5 This case includes all sequences in which the covers of the Melter Cell fall due to a crane load drop accident. An outcome probability of 0.01 is

assigned Branch 2 and an outcome probability of 0.99 is assigned Branch 3.

****SAMPLED VARIABLE****

Case 6 This case includes all sequences in which there is a steam explosion in the Melter. An outcome probability of 0.01 is assigned Branch 2 and an outcome probability of 0.99 is assigned Branch 3.

****SAMPLED VARIABLE****

Case 7 This case includes all sequences in which there is an explosion in the Melter Offgas System. An outcome probability of 1.0 is assigned Branch 3.

Case 8 This case includes all sequences in which there is injection of water to the Melter. A steam explosion does not occur and water injection continues until all the Melter contents are displaced and discharged to the cell floor. An outcome probability of 1.0 is assigned Branch 1.

Case 9 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the Melter and the Melter Offgas System can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 4.

Question 158: Does a Seismic event or tornado rupture and spill the contents of the Organic Waste Storage Tank?

A Seismic event or a tornado can damage the Organic Waste Storage Tank [OWST] causing spillage of the stored organic material, primarily benzene. Spillage of the material is of concern because benzene is a carcinogen and highly flammable. There are two defined outcomes to this question as follows:

RptOWST: The OWST is ruptured and the contents spilled as a result of the Seismic event or tornado.

nRptOWST: The OWST is intact following the seismic event or tornado.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2 and the value specified for the parameter OWSTFr, the fragility of the OWST to a seismic event or tornado. The answers to this question are used in the logic to determine the outcome probabilities in Questions 160 and 161. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event has occurred. The seismic fragility of the OWST [the probability that a seismic event will cause a structural failure of the OWST] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 2 This case includes all sequences in which a tornado has impacted the OWST [Question 2, Branch 3]. The tornado fragility of the OWST [the probability that a tornado will cause a structural failure of the OWST] is

placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2.

NOTE: The tornado portion of the above question was included as a place holder. Only the seismic portion of this question was used for the current analysis. It is recognized that the tornado fragility would be different than the seismic fragility.

Question 159: Does an explosive concentration accumulate in the Organic Waste Storage Tank?

Nitrogen is provided to the inner tank of the OWST to protect against combustion of the benzene vapors. An explosion can occur in the inner tank if the amount of oxygen in the vapor space reaches the minimum required for combustion and the vapor is ignited. An explosion can occur in the annulus between the inner and outer tanks if sufficient benzene leaks from the inner tank and the benzene vapors are ignited. A fault tree was constructed to calculate the frequency of explosions in the OWST for all credible initiators [5]. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the OWST. The two outcomes defined for this question are as follows:

ConOWST: An explosive concentration accumulates in the OWST.

nConOWST: An explosive concentration does not accumulate in the OWST.

This is a Type 6 question and uses previously quantified parameters [60, 61, 67, 70, 71, 90, and 94] and a user defined function to determine the probability that an explosive concentration will occur in the OWST. The user function includes information from solution of the fault tree for an OWST explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 160.

The following case structure is simplified by not considering the possibility of prior rupture of the OWST during a Seismic event or a tornado [Question 158]. Rupture of the OWST would prevent the buildup of an explosive concentration. The possibility of prior rupture of the OWST is included in Question 160. Four cases are used to develop the outcome probabilities as follows:

Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2.

Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-OWST and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-OWSTS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 160: Does a damaging deflagration occur in the Organic Waste Storage Tank [OWST]?

If an explosive concentration occurs in the Organic Waste Storage Tank [OWST] and an ignition source is available it is assumed that a damaging explosion will follow. The fault tree for the OWST deflagration includes the probability of an ignition source. Therefore, if Question 159 indicates that an explosive concentration is available then a deflagration will follow. A deflagration in the OWST will rupture the tank spilling the inventory. There are two defined outcomes as follows:

- OWST-Def: A damaging deflagration occurs in the OWST.
- nOWST-Ex: No damaging explosion occurs in the OWST.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 158 and 159. The answers to this question are used in the logic to determine the outcome probabilities in Question 161. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the OWST. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes the sequences in which a prior event has ruptured the OWST, therefore, spilling the contents and precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 2.
- Case 3 This case includes the sequences in which a prior event has not ruptured the OWST and an explosive concentration has accumulated in the system. The outcome probability assigned is 1.0 in Branch 1.
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging deflagration are included in previous cases. The outcome probability assigned is 1.0 in Branch 2.

- Case 3 This case includes the sequences in which a prior event has not ruptured the PPPT and an explosive concentration has accumulated in the vessel. An outcome probability of 0.001 is assigned Branch 1 and an outcome probability of 0.999 is assigned Branch 2 [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3, there is no explosion.

Question 167: Does splashing [spillage] of the Pump Pit Precipitate Tank contents occur?

If the Pump Pit Precipitate Tank [PPPT] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PPPT can be caused by falling cell covers, by shaking during a Seismic event and by an explosion associated with the PPPT. Spilling the contents of the PPPT is of concern because the contents are radioactive. There are two defined outcomes as follows:

- PPPTSpl: The contents of the PPPT are spilled into the Low Point Pump Pit.
- nPPPTSpl: The contents of the PPPT are not spilled into the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 164 and 166 and are used in the logic to determine the outcome probabilities in Questions 169 and 171. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was no explosion of the PPPT and there was no seismic initiated rupture of the PPPT. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a prior rupture of the PPPT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a detonation of the PPPT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the PPPT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 168: Does an explosive concentration accumulate in the Pump Pit Precipitate Tank Cell?

This question was included as a place holder during APET development. Subsequent analysis indicates that it is not possible to develop an explosive mixture in the PPPC. Since no cutset file is provided to the APET for this accident during the quantification of the tree, the UFUN returns a value of 0 for the probability that an explosive concentration exists.

The two outcomes defined for this question are as follows:

- ConPPPC: An explosive concentration accumulates in the Pump Pit Precipitate Tank Cell.
- nConPPPC: An explosive concentration does not accumulate in the Pump Pit Precipitate Tank Cell.

This is a Type 6 question and would use previously quantified parameters and a user defined function to determine the probability that an explosive concentration will occur in the PPPC if it was possible for one to occur. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 169.

The following case structure does not consider leakage from the tank but only extracts information from the fault tree on loss of ventilation to the cell and an ignition source. Leakage from the tank is considered in Question 167. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PPPC and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PPPCS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 169: Does a damaging explosion occur in the Pump Pit Precipitate Tank Cell?

This question was included as a place holder during APET development. Subsequent analysis indicates that it is not possible to develop an explosive

mixture in the PPPC. Since no cutset file is provided to the APET for this accident during the quantification of the tree, the UFUN returns a value of 0 for the probability that an explosive concentration exists. The outcome probabilities for each case in this question have been set to 1.0 in Branch 3, there is no explosion.

There are three defined outcomes as follows:

- PPPCDet: A damaging detonation occurs in the Pump Pit Precipitate Tank Cell.
- PPPCDef: A damaging deflagration occurs in the Pump Pit Precipitate Tank Cell.
- nPPPCExp: No damaging explosion occurs in the Pump Pit Precipitate Tank Cell.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 167 and 168. The answers to this question are used in the logic to determine the outcome probabilities in Questions 170 and 193. Three cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the PPPC [i.e., ventilation is not lost, an ignition source is not available, or no spillage into the cell has occurred]. As stated above, the outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes the sequences in which a prior event has ruptured the PPPT and an explosive concentration does not accumulate in the PPPC. As stated above, the outcome probability assigned is 1.0 in Branch 3.
- Case 3 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. As stated above, the outcome probability assigned is 1.0 in Branch 3.

Question 170: Do the cell covers for the Pump Pit Precipitate Cell dislodge and fall following an energetic event?

A previous question determined the impact of a seismic event on the cell covers. If a seismic event has not occurred it is assumed that the cell covers are in place prior to any in-cell energetic event. If a seismic event has occurred then the cell covers may have been dislodged. The assumed effect of dislodged cell covers on the tanks and equipment in the cell is essentially the same, whether dislodged by a seismic event or an in-cell explosion. Falling cell covers can rupture and spill the contents of the tanks in the Pump Pit Precipitate Cell. There are two defined outcomes as follows:

- fPPPCov: The cell covers dislodge and fall, either the consequence of a seismic event or an in-cell explosion.
- nfPPPCov: The cell covers are in place.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 162, 166, and 169 and are used in the logic to determine the outcome

probabilities in Questions 171 and 193. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was no explosion of the Pump Pit Precipitate Tank, no explosion in the Pump Pit Precipitate Tank Cell, and the cell covers were not dislodged previously by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the cell covers were dislodged previously by a seismic event. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was an explosion of the Pump Pit Precipitate Tank cell. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which there was an explosion of the Pump Pit Precipitate Tank. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 171: Does splashing [spillage] of the Pump Pit Precipitate Tank contents occur?

If the Pump Pit Precipitate Tank [PPPT] is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PPPT can be caused by falling cell covers, by shaking during a Seismic event and by an explosion associated with the PPPT. Spilling the contents of the PPPT is of concern because the contents are radioactive. There are two defined outcomes as follows:

PPPTSpl@2: The contents of the PPPT are spilled into the Low Point Pump Pit.

nPPPTSpl: The contents of the PPPT are not spilled into the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 164 and 166 and are used in the logic to determine the outcome probabilities in Question 169 and 171. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was prior rupture of the PPPT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 This case includes all sequences in which the LPPP cell covers have fallen. An outcome probability of 0.9 is assigned Branch 1 and an outcome probability of 0.1 is assigned Branch 2 [7]. **SAMPLED VARIABLE**

- Case 3 This case includes all sequences in which a crane load drop accident occurs. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the PPST can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 172: Does a Seismic event rupture and spill the contents of the Sludge Tank in the Low Point Pump Pit?

Falling cell covers during a seismic event can rupture and spill the contents of the Pump Pit Sludge Tank [PPST]. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

- RptPPST: The Pump Pit Sludge Tank is as a result of the seismic event.
- nRptPPST: The Pump Pit Sludge Tank is intact following the seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 162, and 163 and the value specified for the parameter PPSTFr, the seismic fragility of the Pump Pit Sludge Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 174 and 175. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes all sequences in which a seismic event has caused the cell covers over the Low Point Pump Pit to fall and strike the tank. The falling cell covers are assumed to rupture and spill the contents of the PPST. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or if they fall they do not strike the tank. The seismic fragility of the PPST [the probability that a seismic event will cause a structural failure of the PPST] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 173: Does an explosive concentration accumulate in Pump Pit Sludge Tank?

A fault tree was constructed to calculate the frequency of explosions in the PPST for all credible initiators [5]. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the PPST. The two outcomes defined for this question are as follows:

- ConPPST: An explosive concentration accumulates in the Pump Pit Sludge Tank.

nConPPST: An explosive concentration does not accumulate in the Pump Pit Sludge Tank.

This is a Type 6 question and uses previously quantified parameters [60, 61, 67, 70, 71, 90, 94, and 113] and a user defined function to determine the probability that an explosive concentration will occur in the PPST. The user function includes information from solution of the fault tree for a PPST explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 174.

The following case structure is simplified by not considering the possibility of prior rupture of the PPST during a seismic event [Question 172]. Rupture of the PPST would prevent the buildup of an explosive concentration in the PPST. The possibility of prior rupture of the PPST is included in Question 174. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PPST and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PPSTS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 174: Does a damaging detonation/deflagration occur in the Pump Pit Sludge Tank?

If an explosive concentration occurs in the Pump Pit Sludge Tank and an ignition source is available it is assumed that a damaging explosion will follow. The fault tree for the PPST explosion includes the probability of an ignition source. Therefore, if Question 173 indicates that an explosive concentration is available then an explosion will follow. An explosion in Pump Pit Sludge Tank will spill the contents of the vessel to the Pump Pit and possibly blow the cell covers. There are three defined outcomes as follows:

- PPSTDet:** A damaging detonation occurs in the Pump Pit Precipitate Tank.
- PPSTDef:** A damaging deflagration occurs in the Pump Pit Precipitate Tank.
- nPPSTExp:** No damaging explosion occurs in the Pump Pit Precipitate Tank.

RuptPPT: The Pump Pit Precipitate Tank is ruptured and the contents spilled as a result of the seismic event.

nRuptPPT: The Pump Pit Precipitate Tank is intact following the seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 162, and 163 and the value specified for the parameter PPPTFr, the seismic fragility of the Pump Pit Precipitate Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 166 and 167. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

Case 1 This case includes all sequences in which a seismic event has caused the cell covers over the Low Point Pump Pit to fall and strike the tank. The falling cell covers are assumed to rupture and spill the contents of the PPPT. An outcome probability of 1.0 is assigned Branch 1.

Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or if they fall they do not strike the PPPT. The seismic fragility of the PPPT [the probability that a seismic event will cause a structural failure of the PPPT] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.

Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 165: Does an explosive concentration accumulate in the Precipitate Tank in the Low Point Pump Pit?

The precipitate slurry transferred from the 200-Area tank farm to the Pump Pit Precipitate Tank [PPPT] is composed primarily of cesium/potassium tetraphenylborate. Benzene is continuously formed in this slurry by radiolytic decomposition. A fault tree was constructed to calculate the frequency of explosions in the PPPT for all credible initiators [5]. The solution of this fault tree (cut sets) is used to determine the frequency (or probability) of an explosive concentration in the PPPT. The two outcomes defined for this question are as follows:

ConPPPT: An explosive concentration accumulates in the Pump Pit Precipitate Tank.

nConPPPT: An explosive concentration does not accumulate in the Pump Pit Precipitate Tank.

This is a Type 6 question and uses previously quantified parameters [67, 70, and 71, 90, 94, and 113] and a user defined function to determine the probability that an explosive concentration will occur in the PPPT. The user function includes information from solution of the fault tree for a PPPT explosion. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 166.

The following case structure is simplified by not considering the possibility of prior rupture of the PPPT during a seismic event [Question 164]. Rupture of the PPPT would prevent the buildup of an explosive concentration in the PPPT. The possibility of prior rupture of the

PPPT is included in Question 166. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PPPT and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PPPTS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 166: Does a damaging detonation/deflagration occur in the Precipitate Tank in the Low Point Pump Pit?

If an explosive concentration occurs in the Pump Pit Precipitate Tank and an ignition source is available it is assumed that a damaging explosion will follow. The fault tree for the PPPT explosion includes the probability of an ignition source. Therefore, if Question 165 indicates that an explosive concentration is available then an explosion will follow. An explosion in Pump Pit Precipitate Tank will spill the contents of the vessel to the Pump Pit and possibly blow the cell covers. There are three defined outcomes as follows:

- PPPTDet: A damaging detonation occurs in the Pump Pit Precipitate Tank.
- PPPTDef: A damaging deflagration occurs in the Pump Pit Precipitate Tank.
- nPPPTExp: No damaging explosion occurs in the Pump Pit Precipitate Tank.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 164 and 165. The answers to this question are used in the logic to determine the outcome probabilities in Questions 167, 170, and 193. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the PPPT. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes the sequences in which a prior event has ruptured the PPPT precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.

Question 161: Does splashing [spillage] of the Organic Waste Storage Tank [OWST] contents occur?

If the Organic Waste Storage Tank [OWST] is ruptured some or all of the contents of the contents will be spilled. Damage to the OWST can be caused by shaking during a Seismic event, by tornadic winds, or by a deflagration associated with the OWST. Spilling the contents of the OWST is of concern because benzene is a carcinogen and is highly flammable. There are two defined outcomes as follows:

OWST-Spl: The OWST is ruptured and its contents spilled.

nOWSTSpl: The OWST is not ruptured and no spillage occurs.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 158 and 160. The answers to this question are used in the source term biner. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there is no explosion associated with the OWST and there was no external event to damage the tank. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which a prior event has ruptured the tank. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a deflagration in the OWST. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the OWST can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 162: Do the cell covers over the Low Point Pump Pit dislodge and fall because of a seismic event (i.e., covers over all three cells)?

The process cells within the main canyon of the DWPF are 'roofed' by removable steel covers. The Pump Pit cells are also 'roofed' by removable covers but constructed of reinforced concrete rather than steel and are, therefore, much heavier. These covers provide limited isolation of the cell in the event of an in-cell release, assist in maintaining proper ventilation flow, and protect the equipment within the cell from falling objects. If the cell covers are dislodged and fall into the cell, either through a seismic event or an energetic event within the cell, they will damage the equipment in the cell. This question examines the impact of a seismic event on the covers for the Low Point Pump Pit. There are two possible outcomes as follows:

fPCvSeis: The Low Point Pump Pit Covers are dislodged by the Seismic event and fall on the equipment [tanks, piping, etc.] in the cell.

nfPCvSei: The Low Point Pump Pit Covers remain in place following the Seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2 and the value specified for the parameter PPCovFr, the seismic fragility of the covers for the Low Point Pump Pit. The answers to this question are used in the logic to determine the outcome probabilities in Questions 163, 170, and 178. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event. The seismic fragility of the covers for the Low Point Pump Pit [the probability the cell covers will fall] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 163: Do the cell covers that fall due to a seismic event strike a vessel in the LPPP?

Falling cell covers during a seismic event can rupture and spill the contents of vessels in the LPPP. There are two possible outcomes as follows:

- PCv-LPPP: The LPPP Cell Covers are dislodged by the Seismic event and strike vessels in the LPPP.
- nPCv-LPPP: The LPPP Cell Covers are dislodged by the Seismic event and do not strike vessels in the LPPP.

This is a Type 2 question. The answer to this question depends upon the outcome of previous Questions 2 and 162. The answers to this question are used in the logic to determine the outcome probabilities in Questions 164, 172, and 180. Two cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes those sequences in which the initiating event is a seismic event and the LPPP cell covers fell due to the seismic event. The outcome probability for Branch 1 is 0.9, the outcome probability for Branch 2 is 0.1 [7].
 SAMPLED VARIABLE.
- Case 2 The default case includes all other sequences. The outcome probability assigned is 1.0 in Branch 2.

Question 164: Does a Seismic event rupture and spill the contents of the Precipitate Tank in the Low Point Pump Pit?

Falling cell covers during a seismic event can rupture and spill the contents of the Pump Pit Precipitate Tank [PPPT]. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 172 and 173. The answers to this question are used in the logic to determine the outcome probabilities in Questions 175, 178, and 193. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the PPST. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes the sequences in which a prior event has ruptured the PPST precluding the accumulation of an explosive concentration. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 This case includes the sequences in which a prior event has not ruptured the PPST and an explosive concentration has accumulated in the vessel. An outcome probability of 0.001 is assigned Branch 1 and an outcome probability of 0.999 is assigned Branch 2 [7]. ****SAMPLED VARIABLE****
- Case 4 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 175: Does splashing [spillage] of the Pump Pit Sludge Tank contents occur?

If the PPST is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PPST can be caused by falling cell covers, shaking during a Seismic event, or from a detonation occurring in the tank. Spilling the contents of the PPST is of concern because the contents are radioactive. There are two defined outcomes as follows:

- PPSTSpl: The contents of the PPST are spilled into the Low Point Pump Pit.
- nPPSTSpl: The contents of the PPST are not spilled into the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Question 172 and 174 and the answers to this question are used in the logic to determine the outcome probabilities in Questions 177 and 179. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was no energetic event in the tank and no seismic initiated rupture of the PPST. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a seismic initiated rupture of the PPST. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a detonation in the PPST. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.

- Case 4 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the PPST can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 176: Does an explosive concentration accumulate in Pump Pit Sludge Cell?

This question was included as a place holder during APET development. Subsequent analysis indicates that it is not possible to develop an explosive mixture in the PPSC. Since no cutset file is provided to the APET for this accident during the quantification of the tree, the UFUN returns a value of 0 for the probability that an explosive concentration exists.

The two outcomes defined for this question are as follows:

- ConPPSC: An explosive concentration accumulates in the Pump Pit Sludge Cell.
- nConPPSC: An explosive concentration does not accumulate in the Pump Pit Sludge Cell.

This is a Type 6 question and would use previously quantified parameters and a user defined function to determine the probability that an explosive concentration will occur in the PPSC if it was possible for one to occur. The function used to calculate the answer depends on the answer to previous Question 1. The outcome probabilities are used in the logic to determine the outcome probabilities in Question 177. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case is used to exclude those sequences in the classes of accidents [Question 1] which are neither external nor internal-energetic. The outcome probability assigned is 1.0 in Branch 2.
- Case 2 This case includes all sequences in which the class of accidents is internal-energetic [Branch 2, Question 1]. The outcome probability is calculated using FUN-PPSC and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 This case includes all sequences in which the class of accidents is external [Branch 1, Question 1]. The outcome probability is calculated using FUN-PPSCS and assigned to Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 4 The default case assumes that all sequences in which an explosive concentration can occur are included in Cases 2 and 3. An outcome probability of 1.0 is assigned Branch 2.

Question 177: Does a damaging detonation/deflagration occur in the Pump Pit Sludge Tank Cell?

This question was included as a place holder during APET development. Subsequent analysis indicates that it is not possible to develop an explosive mixture in the PPSC. Since no cutset file is provided to the APET for this accident during the quantification of the tree, the UFUN returns a value of 0 for the probability that an explosive concentration exists. The outcome probabilities for each case in this question have been set to 1.0 in Branch 3, there is no explosion.

There are three defined outcomes as follows:

- PPSCDet: A damaging detonation occurs in the Pump Pit Sludge Tank Cell.
- PPSCDef: A damaging deflagration occurs in the Pump Pit Sludge Tank Cell.
- nPPSCExp: No damaging explosion occurs in the Pump Pit Sludge Tank Cell.

This is a Type 2 question. The answer is dependent on the outcome of previous Questions 175 and 176. The answers to this question are used in the logic to determine the outcome probabilities in Questions 178 and 193. Three cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which an explosive concentration does not accumulate in the PPSC. The outcome probability assigned is 1.0 in Branch 3.
- Case 2 This case includes the sequences in which a prior event has ruptured the PPST and an explosive concentration does not accumulate in the PPSC. The outcome probability assigned is 1.0 in Branch 3.
- Case 3 The default case includes any remaining sequences. It is assumed that all sequences resulting in a damaging explosion are included in previous cases. The outcome probability assigned is 1.0 in Branch 3.

Question 178: Do the cell covers for the Pump Pit Sludge Cell dislodge and fall following an energetic event?

A previous question determined the impact of a seismic event on the cell covers. If a seismic event has not occurred it is assumed that the cell covers are in place prior to any in-cell energetic event. If a seismic event has occurred then the cell covers may have been dislodged. The assumed effect of dislodged cell covers on the tanks and equipment in the cell is essentially the same, whether dislodged by a seismic event or an in-cell explosion. Falling cell covers can rupture and spill the contents of the tanks in the Pump Pit Sludge Cell. There are two defined outcomes as follows:

- fPPSCov: The cell covers dislodge and fall, either the consequence of a seismic event or an in-cell explosion.
- nfPPSCov: The cell covers are in place.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 162, 174, and 177 and are used in the logic to determine the outcome probabilities in Questions 179 and 193. Five cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was no explosion of the Pump Pit Sludge Tank, no explosion in the Pump Pit Sludge Tank Cell, and the cell covers were not dislodged previously by a seismic event. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which the cell covers were dislodged previously by a seismic event. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there was an explosion of the Pump Pit Sludge Tank Cell. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which there was an explosion of the Pump Pit Sludge Tank. An outcome probability of 1.0 is assigned Branch 1.
- Case 5 The default case includes all sequences remaining and assumes that all means by which the cell covers can fall have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 179: Does splashing [spillage] of the Pump Pit Sludge Tank contents occur?

If the PPST is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PPST can be caused by falling cell covers, by shaking during a seismic event and by an explosion associated with the PPST. Spilling the contents of the PPST is of concern because the contents are radioactive. There are two defined outcomes as follows:

- PPSTSpl@2: The contents of the PPST are spilled into the Low Point Pump Pit.
- nPPSTSpl: The contents of the PPST are not spilled into the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 39, 175, and 178. The answers to this question are used in the source term biner. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was prior rupture of the PPST. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 This case includes all sequences in which the LPPP cell covers have fallen. An outcome probability of 0.9 is assigned Branch 1 and an outcome probability of 0.1 is assigned Branch 2 [7]. ****SAMPLED VARIABLE****

- Case 3 This case includes all sequences in which a crane load drop accident occurs. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the PPST can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 180: Does a Seismic event rupture and spill the contents of the Recycle Tank in the Low Point Pump Pit?

Falling cell covers during a seismic event can rupture and spill the contents of the Pump Pit Recycle Tank [PPRT]. Shaking and overturning of the tank during a seismic event can also cause spillage of the contents. There are two defined outcomes to this question as follows:

- RptPPRT: The Pump Pit Recycle Tank is ruptured and the contents spilled as a result of the seismic event.
- nRptPPRT: The Pump Pit Recycle Tank is intact following the seismic event.

This is a Type 6 question. The answer to this question depends upon the outcome of previous Question 2, 162, and 163 and the value specified for the parameter PPRTFr, the seismic fragility of the Pump Pit Recycle Tank. The answers to this question are used in the logic to determine the outcome probabilities in Questions 181. Three cases are used to develop the outcome probabilities on the basis of prior events as follows:

- Case 1 This case includes all sequences in which a seismic event has caused the cell covers over the Low Point Pump Pit to fall. The falling cell covers are assumed to rupture and spill the contents of the PPRT. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 This case includes all sequences in which a seismic event has occurred but the cell covers do not fall or if they fall they do not strike the tank. The seismic fragility of the PPRT [the probability that a seismic event will cause a structural failure of the PPRT] is placed in Branch 1. The outcome probability for Branch 2 is 1.0 less the probability assigned Branch 1.
- Case 3 The default case includes all remaining sequences. The outcome probability assigned is 1.0 in Branch 2, there is no seismic event and the PPRT is undamaged.

Question 181: Does splashing [spillage] of the Pump Pit Recycle Tank contents occur?

If the PPRT is damaged some or all of the contents of the tank may be spilled to the floor. Damage to the PPRT can be caused by falling cell covers or by shaking during a seismic event.

Spilling the contents of the PPRT is of concern because the contents are radioactive and also may include some residual benzene. There are two defined outcomes as follows:

- PPRTSpl: The contents of the PPRT are spilled into the Low Point Pump Pit.
- nPPRTSpl: The contents of the PPRT are not spilled into the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 2, 39, and 180. The answers to this question are used in the source term binner. Four cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all sequences in which there was no seismic initiated rupture of the PPRT. An outcome probability of 1.0 is assigned Branch 2.
- Case 2 This case includes all sequences in which there was a seismic rupture of the PPRT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which there is a crane load drop accident that damages the PPRT. Spillage of the tank contents will occur. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 The default case includes all sequences remaining and assumes that all means by which spillage of the contents of the PPRT can occur have been included in the previous cases. An outcome probability of 1.0 is assigned Branch 2.

Question 182: Does an uncontrolled reaction occur in the CPC?

Uncontrolled reactions are defined as the sudden loss of part of the contents of a vessel [eructation], foaming, boilover, gassing, or an undesirable high temperature causing material decomposition with evolution of hazardous vapors. There are two defined outcomes as follows:

- UcRx-CPC: An uncontrolled reaction occurs in the CPC.
- nUcRx-CPC: No uncontrolled reaction occurs in the CPC.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 5 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all events defined by Question 1, Branch 4 [accident class -LtdMisc] and Question 5, Branch 2 [CPC-UcR]. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 183: Does an uncontrolled reaction occur in the SPC?

Uncontrolled reactions are defined as the sudden loss of part of the contents of a vessel [eructation], foaming, boilover, gassing, or an undesirable high temperature causing material decomposition with evolution of hazardous vapors. There are two defined outcomes as follows:

UcRx-SPC: An uncontrolled reaction occurs in the SPC.

nUcRx-SPC: No uncontrolled reaction occurs in the SPC.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 5 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 1, Branch 4 [accident class -LtdMisc] and Question 5, Branch 4 [PR-UcR]. An outcome probability of 1.0 is assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 184: Does a vessel overflow occur in the CPC?

Overflow occurs when the volumetric capacity of a vessel is exceeded. The result may be the loss of process liquid to the cell floor or sump, the vessel vent header, or another vessel. There are two defined outcomes as follows:

CPCOfvl: A vessel overflow occurs in the CPC.

nCPCOfvl: No vessel overflow occurs in the CPC.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 3 [CPC-Oflow]. An outcome probability of 1.0 is assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 185: Does a vessel overflow of process material occur in the SPC?

Overflow occurs when the volumetric capacity of a vessel is exceeded. The result may be the loss of process liquid to the cell floor or sump, the vessel vent header, or another vessel. In the SPC, the PR and PRFT contain process material. This question is concerned with a PR or PRFT overflow. There are two defined outcomes as follows:

SPCOvfl: A vessel overflow of process material occurs in the SPC.

nSPCOvfl: No vessel overflow of process material occurs in the SPC.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 11 [SPC-Oflow]. An outcome probability of 1.0 is assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 186: Does a vessel overflow of benzene occur in the SPC?

Overflow occurs when the volumetric capacity of a vessel is exceeded. The result may be the loss of process liquid to the cell floor or sump, the vessel vent header, or another vessel. In the SPC, the OEV and OECT contain process material. This question is concerned with a OEV or OECT overflow. There are two defined outcomes as follows:

BnzOvfl: A vessel overflow of benzene occurs in the SPC.

nBnzOvfl: No vessel overflow of benzene occurs in the SPC.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 9 [BZ-Oflow]. An outcome probability of 1.0 is assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 187: Does a vessel overflow occur in the Low Point Pump Pit?

Overflow occurs in the Pump Pit when the volumetric capacity of a tank is exceeded. The result may be the loss of process liquid to the cell floor or sump or the vessel vent header. There are two defined outcomes as follows:

LPP-OvFl: A vessel overflow occurs in the Low Point Pump Pit.

nLPPOvFl: No vessel overflow occurs in the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

- Case 1 -- This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 4 [PP-Oflow]. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 188: Does a leak occur in the Chemical Process Cell?

Leaks permit process fluids to penetrate the primary confinement structures such as vessels and piping. The consequences are generally small but can range from the loss of a few milliliters of solution to all of the material in holdup. Leaks can involve significant amounts of radioactive material. There are two defined outcomes as follows:

- CPCLeak: A leak occurs in the Chemical Process Cell.
- nCPCLeak: No leak occurs in the Chemical Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 5 [CPC-Leak]. An outcome probability of 1.0 is assigned Branch 1.
- Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 189: Does a leak of process material occur in the Salt Process Cell?

Leaks permit process fluids to penetrate the primary confinement structures such as vessels and piping. The consequences are generally small but can range from the loss of a few milliliters of solution to all of the material in holdup. Leaks can involve significant amounts of radioactive material. There are two defined outcomes as follows:

- SPCLeak: A leak of process material occurs in the Salt Process Cell.
- nSPCLeak: No leak of process material occurs in the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 6 [SPC-Leak]. An outcome probability of 1.0 is assigned Branch 1.

- Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 190: Does a leak of benzene occur in the Salt Process Cell?

Leaks permit process fluids to penetrate the primary confinement structures such as vessels and piping. The consequences are generally small but can range from the loss of a few milliliters of solution to all of the material in holdup. Leaks can involve significant amounts of radioactive material. Leaks of benzene are of particular concern due to the possibility of subsequent deflagrations in the SPC. There are two defined outcomes as follows:

- BnzLeak: A leak of benzene occurs in the Salt Process Cell.
nBnzLeak: No leak of benzene occurs in the Salt Process Cell.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 10 [BZ-Leak]. An outcome probability of 1.0 is assigned Branch 1.
Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 191: Does an incidental leak occur in the Pump Pits?

Leaks permit process fluids to penetrate the primary confinement structures such as vessels and piping. The consequences are generally small but can range from the loss of a few milliliters of solution to all of the material in holdup. Leaks can involve significant amounts of radioactive material. There are two defined outcomes as follows:

- LPPLLeak: A leak occurs in the Low Point Pump Pit.
nLPPLLeak: No leak occurs in the Low Point Pump Pit.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

- Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 7 [PP-Leak]. An outcome probability of 1.0 is assigned Branch 1.
Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 192: Does the rupture of a filled storage canister occur?

Fully encapsulated canisters are resistant to rupture if dropped or impacted by most objects. Tests show that fully encapsulated canisters can be dropped from heights of up to 30 feet without rupturing. However, canisters can be breached during processing and prior to completion of encapsulation although a breach is unlikely. There are two defined outcomes as follows:

CanRpt: Rupture of a storage canister occurs.

nCanRpt: No rupture of a storage canister occurs.

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 1 and 4 and are referenced in the source term binning file. Two cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all events defined by Question 1, Branch 3 [accident class -LtdLeak] and Question 4, Branch 8 [Can-Rpt]. An outcome probability of 1.0 is assigned Branch 1.

Case 2 The default case includes all sequences remaining. An outcome probability of 1.0 is assigned Branch 2.

Question 193: What is the status of the ventilation for the Low Point Pump Pit Building?

There are four defined outcomes as follows:

PPnFn/Br: The cells in Low Point Pump Pit Building are breached [cell covers blown or ventilation system breached] and the exhaust fans are not operating.

PPnF/nBr: The cells in Low Point Pump Pit Building are not breached [cell covers not blown] and the exhaust fans are not operating.

PPFan/Br: The cells in Low Point Pump Pit Building are breached [cell covers blown] and the exhaust fans are operating.

LPPVent: The ventilation system for the Low Point Pump Pit Building is functioning

This is a Type 2 question. The answers to this question are dependent on the outcome of previous Questions 2, 3, 8, 9, 166, 169, 170, 174, 177, and 178. The outcomes are used in the source term binning file. Seven cases are used to develop the outcome probabilities as follows:

Case 1 This case includes all sequences in which a seismic event or tornadic winds has occurred. It is assumed that the building housing the Pump Pits has been destroyed, the vent system damaged and the exhaust fans damaged. Cell covers may or may not be in place. An outcome probability of 1.0 is assigned Branch 1.

- Case 2 This case includes all sequences in which electrical power failure causes failure of the exhaust fans and an explosion in the PPPT or PPPC has caused dislodging of the cell covers. An outcome probability of 1.0 is assigned Branch 1.
- Case 3 This case includes all sequences in which electrical power failure causes failure of the exhaust fans and an explosion in the PPST or PPSC has caused dislodging of the cell covers. An outcome probability of 1.0 is assigned Branch 1.
- Case 4 This case includes all sequences in which electrical power failure causes failure of the exhaust fans and the cell covers are in place. An outcome probability of 1.0 is assigned Branch 2.
- Case 5 This case includes all sequences in which the exhaust fans are operating and an explosion in the PPPT or PPPC has caused dislodging of the cell covers. An outcome probability of 1.0 is assigned Branch 3.
- Case 6 This case includes all sequences in which the exhaust fans are operating and an explosion in the PPST or PPSC has caused dislodging of the cell covers. An outcome probability of 1.0 is assigned Branch 3.
- Case 7 The default case includes all sequences remaining. It is assumed that all sequences in which the Ventilation System for the Pump Pit is not functioning normally are included in the above cases. An outcome probability of 1.0 is assigned Branch 4.

5. THE SOURCE TERM BINNER

For this analysis the information of primary concern was the radionuclide source term that could result from damage to one or more of the process vessels in the DWPF. The primary binning of the APET sequences, therefore, serves as a source term binner. APET sequences are binned into groups that are expected to yield similar radionuclide source terms. Of particular interest is the severity of damage to each of the vessels (e.g., is a tank destroyed by detonation or is it vented by flying shrapnel). This information establishes the initial size and mode of release. Also, of interest is the condition of the building ventilation ducts and fans which may or may not be available to mitigate the release. The binner is discussed in the following paragraphs.

Nineteen characteristics or dimensions are used in the source term binner and characterize the accident in terms of damage to the various process vessels within the DWPF and the status of barriers to release and mitigation systems. For detailed descriptions of each vessel and contents see Reference 1. The EVNTRE software ensures that every accident progression sequence identified as having significance [i.e., above a specified cutoff frequency] is assigned to a primary bin. It is the frequencies of these bins that are reported in the SAR. Each sequence that is not truncated based on frequency is placed into a bin according to the values for each dimension. The bin frequency is the sum of the frequencies for all accident progression sequences that had the same end state for each of the 19 dimensions in the bin. For every dimension there is an attribute defined that is appropriate for every accident progression sequence. If the user fails to define the attributes for each dimension such that this is true, the EVNTRE software generates an error condition and flags the accident progression sequence that cannot be binned. Any sequence characteristic that is potentially significant to understanding the accident progression or determining the source term is included in the list of attributes considered in developing the accident progression bins. [These attributes are similar to the branch points of a top event or question.]

The results of the source term binner are used by the DWPF Algorithm for Source Terms (DWPFFAST) which reads the accident progression bins, and calculates an individual radiological source term for each [14].

The dimensions used in the DWPF analysis are:

- OWST STATUS
- LOW POINT PUMP PIT SLUDGE PUMP TANK STATUS
- LOW POINT PUMP PIT PRECIPITATE PUMP TANK STATUS
- LOW POINT PUMP PIT RECYCLE WASTE PUMP TANK STATUS
- PRECIPITATE REACTOR STATUS
- PRECIPITATE REACTOR FEED TANK STATUS
- PRECIPITATE REACTOR BOTTOMS TANK STATUS
- SLURRY MIX EVAPORATOR TANK STATUS
- SLUDGE RECEIPT AND ADJUSTMENT TANK STATUS
- MELTER FEED TANK STATUS
- RECYCLE COLLECTION TANK STATUS
- MELT CELL STATUS
- DEFLAGRATION IN SPC
- FIRE IN SPC
- CPC CELL COVER STATUS
- SPC CELL COVER STATUS
- MELT CELL COVER STATUS

ZONE 1 VENTILATION STATUS LPPP VENTILATION STATUS

The EXCEL Spreadsheet for the source term biner is shown at the end of the APET in Appendix A. Each element or dimension of the biner is discussed in the paragraphs that follow.

1. OWST

The first dimension addresses the condition of the OWST. The OWST contains small amounts of radionuclides which could be released if the tank deflagrates and material is spilled to the ground. The OWST is considered to have three end states characteristics:

Deflagration, splash or no release, (these are listed on the first line of the dimension data for the OWST)

(The OWST dimension statements then reference the following cases in the APET questions to determine the total frequency of the outcome.)

- Accident sequences in which the OWST has deflagrated are binned in the OWSTDef attribute. Deflagration of the OWST is assigned to the first branch of APET question 160. Each sequence has some frequency calculation for this case. The sum of the frequencies from all sequences is put here.
- Accident sequences in which the OWST has splashed are binned in the OWST/Sp attribute. Splashing of the OWST is assigned to the first branch of APET question 161.
- The frequency that nothing has happened (i.e., no release) to the OWST is determined based on sum of the frequencies calculated by the second branches of questions 160 and 161.

2. PPST

The second dimension addresses the condition of the low point pump pit sludge tank (LPPP PPST) and release mechanisms of radioactive materials. The PPST has six possible characteristics:

Detonation, deflagration, splash, leak, overflow or no release

- Accident sequences in which the PPST has detonated are binned in the PPSTDet attribute. Detonation of the PPST is assigned to the first branch of APET question 174.
- Accident sequences in which the PPST has deflagrated are binned in the PPSTDef attribute. Deflagration of the PPST is assigned to the second branch of APET question 174.

- Accident sequences in which the PPST has splashed are binned in the PPSSpl attribute. Splashing of the PPST is assigned to the first branch of APET question 179.
- Accident sequences in which the PPST has leaked are binned in the PPSLeak attribute. Leaking of the PPST is assigned to the first branch of APET question 191.
- Accident sequences in which the PPST has overflowed are binned in the PPSOvFl attribute. Overflowing of the PPST is assigned to the first branch of APET question 187.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 174, 179, 187 and 191 on which nothing happens.

3. PPPT

The third dimension addresses the condition of the low point pump pit precipitate tank (LPPP PPPT) and release mechanisms of radioactive materials. The PPPT has six possible characteristics:

Detonation, deflagration, splash, leak, overflow or no release

- Accident sequences in which the PPPT has detonated are binned in the PPPDet attribute. Detonation of the PPPT is assigned to the first branch of APET question 166.
- Accident sequences in which the PPPT has deflagrated are binned in the PPPDef attribute. Deflagration of the PPPT is assigned to the second branch of APET question 166.
- Accident sequences in which the PPPT has splashed are binned in the PPPSpl attribute. Splashing of the PPPT is assigned to the first branch of APET question 171.
- Accident sequences in which the PPPT has leaked are binned in the PPPLeak attribute. Leaking of the PPPT is assigned to the first branch of APET question 191.
- Accident sequences in which the PPPT has overflowed are binned in the PPPOvFl attribute. Overflowing of the PPPT is assigned to the first branch of APET question 187.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 166, 169, 171, 187 and 191 on which nothing happens.

4. PPRT

The fourth dimension addresses the condition of the low point pump pit recycle tank (LPPP PPRT) and release mechanisms of radioactive materials. The PPRT has four possible characteristics:

Splash, leak, overflow or no release

- Accident sequences in which the PPRT has splashed are binned in the PPRSpl attribute. Splashing of the PPRT is assigned to the first branch of APET question 181.
- Accident sequences in which the PPRT has leaked are binned in the PPRLeak attribute. Leaking of the PPRT is assigned to the first branch of APET question 191.
- Accident sequences in which the PPRT has overflowed are binned in the PPROvFl attribute. Overflowing of the PPRT is assigned to the first branch of APET question 187.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 181, 187 and 191 on which nothing happens.

5. PR

The fifth dimension addresses the condition of the salt process cell precipitate reactor tank (SPC PR) and release mechanisms of radioactive materials. The PR has eight possible characteristics:

Detonation, deflagration, splash, leak, vented, uncontrolled reaction, overflow or no release

- Accident sequences in which the PR has detonated are binned in the PRxDet attribute. Detonation of the PR is assigned to the first branches of APET questions 43, 80 and 123. On a given sequence, only one case can contribute frequency. For a complete APET run, contributions will come from all of the above cases.
- Accident sequences in which the PR has deflagrated are binned in the PRxDef attribute. Deflagration of the PR is assigned to the second branches of APET questions 43, 80 and 123.
- Accident sequences in which the PR has splashed are binned in the PRx-Spl attribute. Splashing of the PR is assigned to the first branches of APET questions 106, 117, 136 and 147. An RPC deflagration (Branch 1, question 147) is postulated to cause sufficient building damage to crush the tanks.
- Accident sequences in which the PR has leaked are binned in the PRx-Leak attribute. Leaking of the PR is assigned to the first branch of APET question 189.
- Accident sequences in which the PR has vented are binned in the PRx-Vent attribute. Venting of the PR is assigned to the first branches of APET questions 75, 95 and 127. Venting is assumed to occur if the salt process cell vent header detonates.
- Accident sequences in which the PR has an uncontrolled reaction are binned in the PRx-UcR attribute. Uncontrolled reaction of the PR is assigned to the first branch of APET question 183.

- Accident sequences in which the PR has overflowed are binned in the PRx-OvFl attribute. Overflow of the PR is assigned to the first branch of APET question 185.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 43, 75, 80, 106, 117, 123, 127, 136, 147, 185, 183, and 189 on which nothing happens.

6. PRFT

The sixth dimension addresses the condition of the salt process cell precipitate reactor tank (SPC PRFT) and release mechanisms of radioactive materials. The PRFT has seven possible characteristics:

Detonation, deflagration, splash, leak, vented, overflow or no release

- Accident sequences in which the PRFT has detonated are binned in the PRFTDet attribute. Detonation of the PRFT is assigned to the first branches of APET questions 55, 86 and 126. On a given sequence, only one case can contribute frequency. For a complete APET run, contributions will come from all of the above cases.
- Accident sequences in which the PRFT has deflagrated are binned in the PRFTDef attribute. Deflagration of the PRFT is assigned to the second branches of APET questions 55, 86 and 126.
- Accident sequences in which the PRFT has splashed are binned in the PRFTSpl attribute. Splashing of the PRFT is assigned to the first branches of APET questions 109, 120, 139 and 147. An RPC deflagration is postulated to cause sufficient building damage to crush the tanks.
- Accident sequences in which the PRFT has leaked are binned in the PRFTLeak attribute. Leaking of the PRFT is assigned to the first branch of APET question 189.
- Accident sequences in which the PRFT has vented are binned in the PRFTVent attribute. Venting of the PRFT is assigned to the first branches of APET questions 75, 95 and 127. Venting is assumed to occur if the salt process cell vent header detonates.
- Accident sequences in which the PRFT has overflowed are binned in the PRFTOvFl attribute. Overflow of the PRFT is assigned to the first branch of APET question 185.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 55, 75, 86, 109, 120, 126, 127, 139, 147, 185, and 189 on which nothing happens.

7. PRBT

The sixth dimension addresses the condition of the chemical process cell precipitate reactor bottoms tank (CPC PRBT) and release mechanisms of radioactive materials. The PRBT has seven possible characteristics:

Detonation, deflagration, splash, leak, vented, overflow or no release

- Accident sequences in which the PRBT has detonated are binned in the PRBT-Det attribute. Detonation of the PRBT is assigned to the first branches of APET questions 60, 88 and 130. On a given sequence, only one case can contribute frequency. For a complete APET run, contributions will come from all of the above cases.
- Accident sequences in which the PRBT has deflagrated are binned in the PRBT-Def attribute. Deflagration of the PRBT is assigned to the second branches of APET questions 60, 88 and 130.
- Accident sequences in which the PRBT has splashed are binned in the PRBT-Spl attribute. Splashing of the PRBT is assigned to the first branches of APET questions 99, 142 and 147. An RPC deflagration is postulated to cause sufficient building damage to crush the tanks.
- Accident sequences in which the PRBT has leaked are binned in the PRBTLeak attribute. Leaking of the PRBT is assigned to the first branch of APET question 188.
- Accident sequences in which the PRBT has vented are binned in the PRBTVent attribute. Venting of the PRBT is assigned to the first branches of APET questions 76, 96 and 134. Venting is assumed to occur if the chemical process cell vent header detonates.
- Accident sequences in which the PRBT has overflowed are binned in the PRBTOvFl attribute. Overflow of the PRBT is assigned to the first branch of APET question 184.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 60, 76, 88, 99, 130, 134, 142, 147, 184, and 188 on which nothing happens.

8. SME

The eighth dimension addresses the condition of the chemical process cell slurry mix evaporator tank (CPC SME) and release mechanisms of radioactive materials. The SME has eight possible characteristics:

Detonation, deflagration, splash, leak, vented, uncontrolled reaction, overflow or no release

- Accident sequences in which the SME has detonated are binned in the SME_Det attribute. Detonation of the SME is assigned to the first branches of APET questions 64, 90 and 131. On a given sequence, only one case can contribute frequency. For a complete APET run, contributions will come from all of the above cases.

- Accident sequences in which the SME has deflagrated are binned in the SME_Def attribute. Deflagration of the SME is assigned to the second branches of APET questions 64, 90 and 131.
- Accident sequences in which the SME has splashed are binned in the SME_Spl attribute. Splashing of the SME is assigned to the first branches of APET questions 100, 143 and 147. An RPC deflagration is postulated to cause sufficient building damage to crush the tanks.
- Accident sequences in which the SME has leaked are binned in the SME_Leak attribute. Leaking of the SME is assigned to the first branch of APET question 188.
- Accident sequences in which the SME has vented are binned in the SME_Vent attribute. Venting of the SME is assigned to the first branches of APET questions 76, 96 and 134. Venting is assumed to occur if the salt process cell vent header detonates.
- Accident sequences in which the SME has an uncontrolled reaction are binned in the SME_UcR attribute. Uncontrolled reaction of the SME is assigned to the first branch of APET question 182.
- Accident sequences in which the SME has overflowed are binned in the SME_OvFl attribute. Overflow of the SME is assigned to the first branch of APET question 184.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 64, 76, 90, 100, 131, 134, 143, 147, 182, 184 and 188 on which nothing happens.

9. SRAT

The ninth dimension addresses the condition of the chemical process cell sludge receipt and adjustment tank (CPC SRAT) and release mechanisms of radioactive materials. The SRAT has eight possible characteristics:

Detonation, Deflagration, Splash, leak, vented, uncontrolled reaction, overflow or no release

- Accident sequences in which the SRAT has detonated are binned in the SRATDet attribute. Detonation of the SRAT is assigned to the first branches of APET questions 68, 92 and 132. On a given sequence, only one case can contribute frequency. For a complete APET run, contributions will come from all of the above cases.
- Accident sequences in which the SRAT has deflagrated are binned in the SRATDef attribute. Deflagration of the SRAT is assigned to the second branches of APET questions 68, 92 and 132.
- Accident sequences in which the SRAT has splashed are binned in the SRATSpl attribute. Splashing of the SRAT is assigned to the first branches of APET

questions 101, 144 and 147. An RPC deflagration is postulated to cause sufficient building damage to crush the tanks.

- Accident sequences in which the SRAT has leaked are binned in the SRATLeak attribute. Leaking of the SRAT is assigned to the first branch of APET question 188.
- Accident sequences in which the SRAT has vented are binned in the SRATVent attribute. Venting of the SRAT is assigned to the first branches of APET questions 76, 96 and 134. Venting is assumed to occur if the salt process cell vent header detonates.
- Accident sequences in which the SRAT has an uncontrolled reaction are binned in the SRATUCRx attribute. Uncontrolled reaction of the SRAT is assigned to the first branch of APET question 182.
- Accident sequences in which the SRAT has overflowed are binned in the SRATOVFl attribute. Overflow of the SRAT is assigned to the first branch of APET question 184.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 68, 92, 132, 101, 144, 147, 76, 134, 188, 184 and 182 on which nothing happens.

10. MFT

The tenth dimension addresses the condition of the chemical process cell melter feed tank (CPC MFT) and release mechanisms of radioactive materials. The MFT has seven possible characteristics:

Detonation, deflagration, splash, leak, vented, overflow or no release

- Accident sequences in which the MFT has detonated are binned in the MFT-Det attribute. Detonation of the MFT is assigned to the first branches of APET questions 74, 94 and 133. On a given sequence, only one case can contribute frequency. For a complete APET run, contributions will come from all of the above cases.
- Accident sequences in which the MFT has deflagrated are binned in the MFT-Def attribute. Deflagration of the MFT is assigned to the second branches of APET questions 74, 94 and 133.
- Accident sequences in which the MFT has splashed are binned in the MFT-Spl attribute. Splashing of the MFT is assigned to the first branches of APET questions 103, 146 and 147. An RPC deflagration is postulated to cause sufficient building damage to crush the tanks.
- Accident sequences in which the MFT has leaked are binned in the MFT-Leak attribute. Leaking of the MFT is assigned to the first branch of APET question 188.

- Accident sequences in which the MFT has vented are binned in the MFT-Vent attribute. Venting of the MFT is assigned to the first branches of APET questions 76, 96 and 134. Venting is assumed to occur if the salt process cell vent header detonates.
- Accident sequences in which the MFT has overflowed are binned in the MFT_OvFl attribute. Overflow of the MFT is assigned to the first branch of APET question 184.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 74, 76, 94, 103, 133, 134, 146, 147, 184, and 188 on which nothing happens.

11. RCT

The eleventh dimension addresses the condition of the chemical process cell recycle collection tank (CPC RCT) and release mechanisms of radioactive materials. The RCT has six possible characteristics:

Splash, leak, vented, uncontrolled reaction, overflow or no release

- Accident sequences in which the RCT has splashed are binned in the RCT_Spl attribute. Splashing of the RCT is assigned to the first branches of APET questions 102, 145 and 147. An RPC deflagration is postulated to cause sufficient building damage to crush the tanks.
- Accident sequences in which the RCT has leaked are binned in the RCT_Leak attribute. Leaking of the RCT is assigned to the first branch of APET question 188.
- Accident sequences in which the RCT has vented are binned in the RCT_Vent attribute. Venting of the RCT is assigned to the first branches of APET questions 76, 96 and 134. Venting is assumed to occur if the salt process cell vent header detonates.
- Accident sequences in which the RCT has an uncontrolled reaction are binned in the RCT_UcRx attribute. Uncontrolled reaction of the RCT is assigned to the first branch of APET question 182.
- Accident sequences in which the RCT has overflowed are binned in the RCT_OvFl attribute. Overflow of the RCT is assigned to the first branch of APET question 184.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 102, 76, 134, 145, 147, 182, 184 and 188 on which nothing happens.

12. Melter and Melter Offgas system

The twelfth dimension addresses the condition of the melter cell tank and the melter offgas system and release mechanisms of radioactive materials. This dimension has five possible characteristics:

Total melter release, partial melter release, melter offgas release, glass cannister rupture or no release

- Accident sequences in which the melter contents are completely released are binned in the TMltRlse attribute. Contents release of the melter is assigned to the first branches of APET questions 157, and 147.
- Accident sequences in which the melter contents are partially released are binned in the pMltRlse attribute. Partial contents release of the melter is assigned to the second branch of APET question 157.
- Accident sequences in which the melter offgas contents are completely released are binned in the MltOGRls attribute. Release of the melter offgas is assigned to the third branch of APET question 157.
- Accident sequences in which the cannister contents are completely released are binned in the Can_Rupt attribute. Release of the cannister contents is assigned to the first branch of APET question 192.
- The frequency for no release is determined by the outcome frequencies of the branches of questions 147, 192, and 157 on which nothing happens.

13. Salt Process Cell Deflagration

The thirteenth dimension addresses the condition of the salt process cell with respect to damage occurred from a deflagration and release mechanisms of radioactive materials. This dimension has two possible characteristics:

SPC deflagration or no deflagration (i.e., no release)

- Accident sequences in which a deflagration occurs in the SPC are binned into the SPC-Def attribute. Deflagration of the SPC is assigned to the first branch of question 121.
- The frequency at which no salt process cell deflagration occurs is determined by the outcome frequencies of the second branch of question 121.

14. Salt Process Cell Fire

The fourteenth dimension addresses the condition of the salt process cell with respect to damage occurred from a fire and release mechanisms of radioactive materials. This dimension has two possible characteristics:

SPC fire or no fire

- Accident sequences in which a fire occurs in the SPC are binned into the SPC-Fire attribute. Fire in the SPC is assigned to the first branch of question 122.
- The frequency at which no salt process cell fire occurs is determined by the outcome frequency of the second branch of question 122.

15. Chemical Process Cell Covers

The fifteenth dimension addresses the condition of the chemical process cell covers and release mechanisms of radioactive materials. This dimension has two possible characteristics:

CPC covers fall or do not fall

- Accident sequences in which the cell covers in the CPC fall are binned into the CPCCvfl attribute. Fallen covers in the CPC is assigned to the first branches of questions 98, 141 and 147.
- The frequency at which the chemical process cell covers do not fall is based on the sum of the frequencies calculated by the second branches of questions 98, 141 or 147.

16. Salt Process Cell Covers

The sixteenth dimension addresses the condition of the salt process cell covers and release mechanisms of radioactive materials. This dimension has two possible characteristics:

SPC covers fall or do not fall

- Accident sequences in which the cell covers in the SPC fall are binned into the SPCCvfl attribute. Fallen covers in the SPC is assigned to the first branches of questions 105, 116 and 128.
- The frequency at which the salt process cell covers do not fall is based on the sum of the frequencies calculated by the second branches of questions 105, 116 or 128.

17. Melter Cell Covers

The seventeenth dimension addresses the condition of the melter cell covers and release mechanisms of radioactive materials. This dimension has two possible characteristics:

Melter cell covers fall or do not fall

- Accident sequences in which the cell covers in the Melter Cell fall are binned into the MCBlown attribute. Fallen covers in the Melter cell is assigned to the first branch of question 156.
- The frequency at which the melter cell covers do not fall is based on the sum of the frequencies calculated by the second branch of question 156.

18. Zone 1 Ventilation

The eighteenth dimension addresses the condition of the zone 1 ventilation and possible reduced mitigation of the ventilation system. This dimension has five possible characteristics:

- Vitrification building collapsed
- Vitrification building collapsed, fans fail, sand filter failed and ventilation duct failed
- Vitrification building collapsed, fans okay, sand filter okay and ventilation duct okay
- Vitrification building okay, fans fail, sand filter failed and ventilation duct failed
- no failures

- Accident sequences in which the vitrification building collapses are binned into the Collapse attribute. Building collapse is assigned to the first branches of questions 110 and 147.
- Accident sequences in which the vitrification building collapses, the fans fail, the sand filter fails and the ventilation duct fails are binned into the nFanBrch attribute. This combination of events is assigned to the first branches of questions 110, 113, 111, and 112.
- Accident sequences in which the vitrification building collapses, the fans do not fail, the sand filter does not fail and the ventilation duct does not fail are binned into the FrFn/Fit attribute. This combination of events is assigned to the first branch of question 110 and the second branches of questions 113, 111, and 112.
- Accident sequences in which the vitrification building does not collapse, but the fans fail, the sand filter fails and the ventilation duct fails are binned into the nFn/nFit attribute. This combination of events is assigned to the second branch of question 110 and the first branches of questions 113, 111, and 112.
- The frequency of no failure to the zone 1 ventilation system is determined based on the sum of the frequencies calculated by the second branches of questions 110, 111, 112, 113 and 147.

19. Low point pump pit ventilation

The nineteenth dimension addresses the condition of the low point pump pit ventilation system and possible reduced mitigation of the ventilation system. This dimension has four possible characteristics:

- Fans fail and building breached
- Fans fail and building okay
- Fans okay and building breached
- No failures

- Accident sequences in which the fans fail and the building is breached are binned into the nFanBrch attribute. This combination of events is assigned to the first branch of question 193.
- Accident sequences in which the fans fail and the building is not breached is binned into the nFn/nBrch attribute. This combination of events is assigned to the second branch of question 193.
- Accident sequences in which the fans do not fail and the building is breached is binned into the Fan/Brch attribute. This combination of events is assigned to the third branch of question 193.
- The frequency for no release is determined based on the sum of the frequencies calculated by the fourth branch of question 193.

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**APPENDIX A: EXCEL Spreadsheet of the Accident Progression Event Tree
for Defense Waste Processing Facility: MODE C**

APPENDIX A
ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	APET FOR DEFENSE WASTE PROCESSING FACILITY - MODE C, REV. C12																	
2		193																
3		NQ																
4		1	1.000															
5		LAST MOD 1/12/95, WMM																
6	1	What is the accident class?																
7		5	External	Int-Equ	LtdLeak	LtdMisc	LtdCD											
8		3	1	2	3	4	5											
9			0.000	0.000	0.000	0.000	1.000											
10		1																
11		98	1.0	1.0	0.0	0.0	0.0					\$Param.	#98	LHS				
12	2	If the accident class is 'external' what is the initiating event?																
13		8	Extrnl	E1-Sels	E2-Wind	E3-Flood	E4-Other	E5-Hell	E6-Plane	E7-Uhcle								
14		4	1	2	3	4	5	6	7	8								
15		3																
16		4	1	1	1	1												
17			2	+3	+4	+5												
18			Int-Equ	LtdLeak	LtdMisc	LtdCD												
19			1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000								
20		63																
21		1	0.00	1.0000	0.00	0.00	0.00	0.00	0.00	0.00		\$Param.	# 1	MsTmEx				
22		2	0.000	0.2468	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 2	NPwrFr				
23		3	0.000	0.0553	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 3	EPwrFr				
24		4	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 4	PStmFr				
25		5	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 5	PCWFr				
26		6	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 6	CO2Fr				
27		7	0.000	0.0120	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 7	AirFr				
28		8	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 8	N2TkFr				
29		9	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 9	ChWFr				
30		10	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 10	CoIFr				
31		11	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 11	BCO2Fr				
32		12	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 12	CanqClps				
33		13	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 13	TrqFr				
34		14	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 14	FluIFr				
35		15	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 15	DuctFr				
36		16	0.000	0.0107	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 16	FanFr				
37		17	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 17	PPITFr				
38		18	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 18	PPSTFr				
39		19	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 19	PPRTFr				
40		20	0.000	0.0010	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 20	PRH-Fr				
41		21	0.000	0.2667	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 21	OEu-Fr				
42		22	0.000	0.2667	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 22	OECTFr				
43		23	0.000	0.0010	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 23	PRFTFr				
44		24	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 24	PRBTFr				
45		25	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 25	SME-Fr				
46		26	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 26	SPCUPSFr				
47		27	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 27	SRAIFr				
48		28	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 28	RCIFr				
49		29	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 29	MFTFr				
50		30	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 30	MeltFr				
51		31	0.000	0.0023	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 31	OWSTFr				
52		32	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 32	PPCouFr				
53		33	0.000	0.0001	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 33	CCouFr				

APPENDIX A
ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
54		34	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 34	IAIrFr				
55		72	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 72	BIK2Fr				
56		73	0.000	0.0120	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 73	CPCN2Fr				
57		74	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 74	NPwrRn				
58		75	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 75	EPwrRn				
59		76	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 76	PStmRn				
60		77	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 77	PCWRn				
61		78	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 78	CO2Rn				
62		80	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 80	AIrRn				
63		81	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 81	N2TKRn				
64		82	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 82	ChWRn				
65		83	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 83	CoTRn				
66		84	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 84	BCO2Rn				
67		85	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 85	IAIrRn				
68		86	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 86	BIK2Rn				
69		87	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 87	CPCN2Rn				
70		96	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 96	FanRn1				
71		97	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 97	CTCmFr				
72		101	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 101	CTCmRn				
73		102	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 102	DWelfr				
74		106	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 106	DWelfRn				
75		107	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 107	CPCTKFr				
76		111	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 111	CPCTKRn				
77		112	0.000	0.0031	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 112	PPN2Fr				
78		116	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 116	PPN2Rn				
79		117	0.000	0.0031	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 117	SPCN2Fr				
80		121	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 121	SPCN2Rn				
81		122	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 122	FanRn2				
82		123	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 123	FanRn3				
83		129	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 129	MO6_Fr				
84		1	1															
85			1															
86			External															
87			0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000								
88		63																
89		1	0.00	1.0000	0.00	0.00	0.00	0.00	0.00	0.00		\$Param.	# 1	MsTmEx				
90		2	0.000	0.2460	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 2	NPwrFr				
91		3	0.000	0.0553	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 3	EPwrFr				
92		4	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 4	PStmFr				
93		5	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 5	PCWFr				
94		6	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 6	CO2Fr				
95		7	0.000	0.0120	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 7	AIrFr				
96		8	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 8	N2TKFr				
97		9	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 9	ChWFr				
98		10	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 10	CoTR				
99		11	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 11	BCO2Fr				
100		12	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 12	CanyClps				
101		13	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 13	TrigFr				
102		14	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 14	FIIRFr				
103		15	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 15	DuctFr				
104		16	0.000	0.0107	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 16	FanFr				
105		17	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 17	PPPIFr				
106		18	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 18	PPSTFr				

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
107		19	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 19	PPATFr				
108		20	0.000	0.0010	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 20	PAH-Fr				
109		21	0.000	0.2667	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 21	OEu-Fr				
110		22	0.000	0.2667	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 22	OECTFr				
111		23	0.000	0.0010	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 23	PAFTFr				
112		24	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 24	PBTFr				
113		25	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 25	SME-Fr				
114		26	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 26	SPCUPSFr				
115		27	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 27	SRATFr				
116		28	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 28	ACTFr				
117		29	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 29	MFTFr				
118		30	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 30	MeltFr				
119		31	0.000	0.0023	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 31	OWSTFr				
120		32	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 32	PPCouFr				
121		33	0.000	0.0001	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 33	CCouFr				
122		34	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 34	IAIrFr				
123		72	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 72	BIK2Fr				
124		73	0.000	0.0120	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 73	CPCN2Fr				
125		74	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 74	NPwrRn				
126		75	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 75	EPwrRn				
127		76	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 76	PStmRn				
128		77	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 77	PCWRn				
129		78	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 78	CO2Rn				
130		80	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 80	AlrRn				
131		81	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 81	N2TKRn				
132		82	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 82	ChWRn				
133		83	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 83	CoTRn				
134		84	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 84	BCO2Rn				
135		85	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 85	IAIrRn				
136		86	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 86	BIK2Rn				
137		87	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 87	CPCN2Rn				
138		96	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 96	FanRn1				
139		97	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 97	CTCmFr				
140		101	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 101	CTCmRn				
141		102	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 102	DWetFr				
142		106	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 106	DWetRn				
143		107	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 107	CPCTkFr				
144		111	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 111	CPCTkRn				
145		112	0.000	0.0031	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 112	PPN2Fr				
146		116	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 116	PPN2Rn				
147		117	0.000	0.0031	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 117	SPCN2Fr				
148		121	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 121	SPCN2Rn				
149		122	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 122	FanRn2				
150		123	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 123	FanRn3				
151		129	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 129	MOG_Fr				
152			Otherwise-no path															
153			1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000								
154		63																
155		1	0.00	1.0000	0.00	0.00	0.00	0.00	0.00	0.00		\$Param.	# 1	MstMEx				
156		2	0.000	0.2468	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 2	NPwrFr				
157		3	0.000	0.0553	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 3	EPwrFr				
158		4	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 4	PStmFr				
159		5	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 5	PCWFr				

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
160		6	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 6	CO2Fr				
161		7	0.000	0.0120	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 7	AlrFr				
162		8	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 8	N2TKFr				
163		9	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 9	ChWFr				
164		10	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 10	CoTfr				
165		11	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 11	BCO2Fr				
166		12	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 12	CanvClps				
167		13	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 13	TrlgFr				
168		14	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 14	FlmFr				
169		15	0.000	0.0002	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 15	DuctFr				
170		16	0.000	0.0107	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 16	FanFr				
171		17	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 17	PPPTFr				
172		18	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 18	PPSTFr				
173		19	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 19	PPATFr				
174		20	0.000	0.0010	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 20	PAH-Fr				
175		21	0.000	0.2667	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 21	OEu-Fr				
176		22	0.000	0.2667	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 22	DECTFr				
177		23	0.000	0.0010	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 23	PRFTFr				
178		24	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 24	PABTFr				
179		25	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 25	SME-Fr				
180		26	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 26	SPCUPSFr				
181		27	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 27	SRAFr				
182		28	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 28	ACTFr				
183		29	0.000	0.0005	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 29	MFTFr				
184		30	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 30	MellFr				
185		31	0.000	0.0023	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 31	OWSTFr				
186		32	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 32	PPCouFr				
187		33	0.000	0.0001	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 33	CCouFr				
188		34	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 34	IAIrFr				
189		72	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 72	BikN2Fr				
190		73	0.000	0.0120	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 73	CPCN2Fr				
191		74	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 74	NPwrRn				
192		75	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 75	EPwrRn				
193		76	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 76	PStmRn				
194		77	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 77	PCWRn				
195		78	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 78	CO2Rn				
196		80	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 80	AlrRn				
197		81	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 81	N2TKRn				
198		82	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 82	ChWRn				
199		83	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 83	CoTRn				
200		84	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 84	BCO2Rn				
201		85	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 85	IAIrRn				
202		86	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 86	BikN2Rn				
203		87	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 87	CPCN2Rn				
204		96	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 96	FanRn1				
205		97	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 97	CTCmFr				
206		101	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 101	CTCmRn				
207		102	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 102	DWelfr				
208		106	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 106	DWelfr				
209		107	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 107	CPCTKFr				
210		111	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 111	CPCTKRn				
211		112	0.000	0.0031	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 112	PPN2Fr				
212		116	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 116	PPN2Rn				

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
213		117	0.000	0.0031	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 117	SPCN2Fr				
214		121	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 121	SPCN2Rn				
215		122	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 122	FanRn2				
216		123	0.000	0.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 123	FanRn3				
217		129	0.000	1.0000	0.000	0.000	0.000	0.000	0.000	0.000		\$Param.	# 129	M06_Fr				
218		3 Is failure of a common (ie., support) system the initiating event?																
219		11	nCoSyn	NPowInit	PStmInit	IAirInit	CO2Init	AirInit	N2TKInit	ChWInit	CoTInit	BIKN2Init	CTCmInit					
220		4	1	2	3	4	5	6	7	8	9	10	11					
221		3																
222		4	1	1	1	1												
223			1	+3	+4	+5												
224			External	LtdLeak	LtdMisc	LtdCD												
225			1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000					
226		1																
227		35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		\$Par# 35	MstMint		
228		1	1															
229			2															
230			Int-Eqy															
231			0.99949	3.45E-05	2.13E-04	1.89E-05	1.16E-04	2.31E-05	2.90E-05	1.47E-05	2.47E-06	4.30E-05	1.05E-05					
232		1																
233		35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
234			Otherwise-no path															
235			1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000					
236		1																
237		35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
238		4 If the accident class is an 'Internal' event classified 'leak' what is the frequency of the event?																
239		11	nIntLeak	MltR-Leak	CPC-Oflow	PP-Oflow	CPC-Leak	SPC-Leak	PP-Leak	Can-Rup	BZ-Oflow	BZ-Leak	SPC-Oflow					
240		2	1	2	3	4	5	6	7	8	9	10	11					
241		2																
242		1	1															
243			3															
244			LtdLeak															
245			0.990281	0.00E+00	9.74E-06	9.74E-06	4.20E-04	4.20E-04</										

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266			Otherwise- not CD															
267			1.000	0.000														
268	7	What are the support system failure frequencies and repair times?																
269		1	Lam/Tau															
270		4	1															
271		3																
272		1	1															
273			2															
274			Int-Equ															
275			1.000															
276		40																
277		36	3.48E-05									\$Param.	# 36	NPwrLmda				
278		37	1.09E-02									\$Param.	# 37	EPwrLmda				
279		38	2.22E-04									\$Param.	# 38	PStmLmda				
280		39	2.30E-03									\$Param.	# 39	PCWlmda				
281		40	6.76E-05									\$Param.	# 40	CO2Lmda				
282		41	1.85E-05									\$Param.	# 41	AlrLmda				
283		42	7.92E-06									\$Param.	# 42	N2TKLmda				
284		43	2.29E-05									\$Param.	# 43	ChWLmda				
285		44	1.08E-03									\$Param.	# 44	FanLmda1				
286		45	1.11E-05									\$Param.	# 45	IAirLmda				
287		46	6.21E-06									\$Param.	# 46	CoTLmda				
288		47	6.23E-03									\$Param.	# 47	BCO2Lmda				
289		48	8.50E+00									\$Param.	# 48	NPwrTau				
290		49	1.00E+00									\$Param.	# 49	EPwrTau				
291		50	5.49E+01									\$Param.	# 50	PStmTau				
292		51	1.00E+00									\$Param.	# 51	PCWTau				
293		52	8.00E+00									\$Param.	# 52	CO2Tau				
294		53	5.12E+01									\$Param.	# 53	AlrTau				
295		54	1.72E+01									\$Param.	# 54	N2TKTau				
296		55	1.43E+01									\$Param.	# 55	ChWTau				
297		56	1.00E+00									\$Param.	# 56	FanTau1				
298		57	2.65E+01									\$Param.	# 57	IAirTau				
299		58	9.02E+01									\$Param.	# 58	CoTTau				
300		59	1.00E+00									\$Param.	# 59	BCO2Tau				
301		79	1.00E+00									\$Param.	# 79	Dummy				
302		88	5.41E-06									\$Param.	# 88	BIKN2Lmda				
303		89	1.96E+01									\$Param.	# 89	BIKN2Tau				
304		91	3.27E-03									\$Param.	# 91	CPCN2Lmda				
305		92	1.00E+00									\$Param.	# 92	CPCN2Tau				
306		99	1.00E-05									\$Param.	# 99	CTCmLmda				
307		100	5.50E+00									\$Param.	# 100	CTCmTau				
308		104	5.29E-03									\$Param.	# 104	DWellLmda				
309		105	1.00E+00									\$Param.	# 105	DWellTau				
310		109	3.82E-05									\$Param.	# 109	CPCTKLmda				
311		110	1.00E+00									\$Param.	# 110	CPCTKTau				
312		114	5.16E-04									\$Param.	# 114	PPN2Lmda				
313		115	1.00E+00									\$Param.	# 115	PPN2Tau				
314		119	4.11E-04									\$Param.	# 119	SPCN2Lmda				
315		120	1.00E+00									\$Param.	# 120	SPCN2Tau				
316		124	7.42E-03									\$Param.	# 124	FanLmda2				
317		125	1.00E+00									\$Param.	# 125	FanTau2				
318		126	3.51E-05									\$Param.	# 126	FanLmda3				

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ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

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319		127	1.00E+00									\$Param.	# 127	FanTau3				
320		130	3.11E-04									\$Param.	# 130	TrigLmda				
321		131	1.00E+00									\$Param.	# 131	TrigTau				
322		132	4.78E-04									\$Param.	# 132	SUPSLmda				
323		133	1.00E+00									\$Param.	# 133	SUPSTau				
324		134	0.00E+00									\$Param.	# 134	Zero				
325		1	1															
326			1															
327			External															
328			1.000															
329		48																
330		36	3.48E-05									\$Param.	# 36	NPwrLmda				
331		37	1.89E-02									\$Param.	# 37	EPwrLmda				
332		38	2.22E-04									\$Param.	# 38	PStmLmda				
333		39	2.30E-03									\$Param.	# 39	PCWLmda				
334		40	6.76E-05									\$Param.	# 40	CO2Lmda				
335		41	1.85E-05									\$Param.	# 41	AlrLmda				
336		42	7.92E-06									\$Param.	# 42	N2TkLmda				
337		43	2.29E-05									\$Param.	# 43	ChWLmda				
338		44	1.00E-03									\$Param.	# 44	FanLmda1				
339		45	1.11E-05									\$Param.	# 45	IAIrLmda				
340		46	6.21E-06									\$Param.	# 46	CoTLmda				
341		47	6.23E-03									\$Param.	# 47	BCO2Lmda				
342		48	8.50E+00									\$Param.	# 48	NPwrTau				
343		49	1.00E+00									\$Param.	# 49	EPwrTau				
344		50	5.49E+01									\$Param.	# 50	PStmTau				
345		51	1.00E+00									\$Param.	# 51	PCWTau				
346		52	8.80E+00									\$Param.	# 52	CO2Tau				
347		53	5.12E+01									\$Param.	# 53	AlrTau				
348		54	1.72E+01									\$Param.	# 54	N2TkTau				
349		55	1.43E+01									\$Param.	# 55	ChWTau				
350		56	1.00E+00									\$Param.	# 56	FanTau1				
351		57	2.65E+01									\$Param.	# 57	IAIrTau				
352		58	9.02E+01									\$Param.	# 58	CoTTau				
353		59	1.00E+00									\$Param.	# 59	BCO2Tau				
354		79	1.00E+00									\$Param.	# 79	Dummy				
355		88	5.41E-06									\$Param.	# 88	BIkN2Lmda				
356		89	1.96E+01									\$Param.	# 89	BIkN2Tau				
357		91	3.27E-03									\$Param.	# 91	CPCN2Lmda				
358		92	1.00E+00									\$Param.	# 92	CPCN2Tau				
359		99	1.00E-05									\$Param.	# 99	CTCmLmda				
360		100	5.50E+00									\$Param.	# 100	CTCmTau				
361		104	5.29E-03									\$Param.	# 104	DWellLmda				
362		105	1.00E+00									\$Param.	# 105	DWellTau				
363		109	3.82E-05									\$Param.	# 109	CPCTkLmda				
364		110	1.00E+00									\$Param.	# 110	CPCTkTau				
365		114	5.16E-04									\$Param.	# 114	PPN2Lmda				
366		115	1.00E+00									\$Param.	# 115	PPN2Tau				
367		119	4.11E-04									\$Param.	# 119	SPCN2Lmda				
368		120	1.00E+00									\$Param.	# 120	SPCN2Tau				
369		124	7.42E-03									\$Param.	# 124	FanLmda2				
370		125	1.00E+00									\$Param.	# 125	FanTau2				
371		126	3.51E-05									\$Param.	# 126	FanLmda3				

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372		127	1.00E+00									\$Param.	# 127	FanTau3				
373		130	3.11E-04									\$Param.	# 130	TrigLmda				
374		131	1.00E+00									\$Param.	# 131	TrigTau				
375		132	4.70E-04									\$Param.	# 132	SUPSLmda				
376		133	1.00E+00									\$Param.	# 133	SUPSTau				
377		134	0.00E+00									\$Param.	# 134	Zero				
378			Otherwise															
379			1.000															
380		48																
381		36	3.48E-05									\$Param.	# 36	NPwrLmda				
382		37	1.09E-02									\$Param.	# 37	EPwrLmda				
383		38	2.22E-04									\$Param.	# 38	PStmLmda				
384		39	2.30E-03									\$Param.	# 39	PCWLmda				
385		40	6.76E-05									\$Param.	# 40	CO2Lmda				
386		41	1.05E-05									\$Param.	# 41	AlrLmda				
387		42	7.92E-06									\$Param.	# 42	N2TKLmda				
388		43	2.29E-05									\$Param.	# 43	ChWLmda				
389			0.00E-03									\$Param.	# 44	FanLmda				
390			1E-05									\$Param.	# 45	IAirLmda				
391			0.21E-06									\$Param.	# 46	CoTLmda				
392		47	6.23E-03									\$Param.	# 47	BCO2Lmda				
393		48	8.50E+00									\$Param.	# 48	NPwrTau				
394		49	1.00E+00									\$Param.	# 49	EPwrTau				
395		50	5.49E+01									\$Param.	# 50	PStmTau				
396		51	1.00E+00									\$Param.	# 51	PCWTau				
397		52	8.00E+00									\$Param.	# 52	CO2Tau				
398		53	5.12E+01									\$Param.	# 53	AlrTau				
399		54	1.72E+01									\$Param.	# 54	N2TKTau				
400		55	1.43E+01									\$Param.	# 55	ChWTau				
401		56	1.00E+00									\$Param.	# 56	FanTau				
402		57	2.65E+01									\$Param.	# 57	IAirTau				
403		58	9.02E+01									\$Param.	# 58	CoTTau				
404		59	1.00E+00									\$Param.	# 59	BCO2Tau				
405		79	1.00E+00									\$Param.	# 79	Dummy				
406		88	5.41E-06									\$Param.	# 88	BIK2Lmda				
407		89	1.96E+01									\$Param.	# 89	BIK2Tau				
408		91	3.27E-03									\$Param.	# 91	CPCN2Lmda				
409		92	1.00E+00									\$Param.	# 92	CPCN2Tau				
410		99	1.00E-05									\$Param.	# 99	CTCmLmda				
411		100	5.50E+00									\$Param.	# 100	CTCmTau				
412		104	5.29E-03									\$Param.	# 104	DIWellLmda				
413		105	1.00E+00									\$Param.	# 105	DIWellTau				
414		109	3.82E-05									\$Param.	# 109	CPCTKLmda				
415		110	1.00E+00									\$Param.	# 110	CPCTKTau				
416		114	5.16E-04									\$Param.	# 114	PPN2Lmda				
417		115	1.00E+00									\$Param.	# 115	PPN2Tau				
418		119	4.11E-04									\$Param.	# 119	SPCN2Lmda				
419		120	1.00E+00									\$Param.	# 120	SPCN2Tau				
420		124	7.42E-03									\$Param.	# 124	FanLmda2				
421		125	1.00E+00									\$Param.	# 125	FanTau2				
422		126	3.51E-05									\$Param.	# 126	FanLmda3				
423		127	1.00E+00									\$Param.	# 127	FanTau3				
424		130	3.11E-04									\$Param.	# 130	TrigLmda				

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
531	11	Does the Instrument Air System fail due to a seismic event?																
532		2	IAIRSe	nIAIRSe														
533		6	1	2														
534		2																
535		1	1															
536			1															
537			External															
538		5	45	57	34	85	1											
539			IAIRLmda	IAIRTau	IAIRFr	IAIRRn	MsTmEx											
540			UAVAIL															
541			EQUAL	0														
542		The Instrument Air System is unavailable, falls from external event, or falls randomly during period MsTmEx																
543		Otherwise																
544		1	79															
545			Dummy															
546			ADD															
547			GETHRESH	1	100.0	\$Large comparison parameter forces assignment to branch 2.												
548		Otherwise No Failure																
549	12	Does the Cooling Tower Common System fail due to random events?																
550		2	CTCmRF	nCTCmRF														
551		6	1	2														
552		2																
553		2	1	3														
554			2	-11														
555			Int-Equ	/CTCminIt														
556		2	99	100														
557			CTCmLmda	CTCmTau														
558			UAVAIL															
559			EQUAL	0														
560		The Cooling Tower Common System unavailability																
561		Otherwise																
562		1	79															
563			Dummy															
564			ADD															
565			GETHRESH	1	100.0	\$Large comparison parameter forces assignment to branch 2.												
566		Otherwise No Failure																
567	13	Does the Cooling Tower Common System fail due to a seismic event?																
568		2	CTCmSe	nCTCmSe														
569		6	1	2														
570		2																
571		1	1															
572			1															
573			External															
574		5	99	100	97	101	1											
575			CTCmLmda	CTCmTau	CTCmFr	CTCmRn	MsTmEx											
576			UAVAIL															
577			EQUAL	0														
578		The Instrument Air System is unavailable, falls from external event, or falls randomly during period MsTmEx																
579		Otherwise																
580		1	79															
581			Dummy															
582			ADD															
583			GETHRESH	1	100.0	\$Large comparison parameter forces assignment to branch 2.												

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
584																	
585	14 Does the Deep Well System fail due to random events?	2 Dwellrf	nDwellrf														
586																	
587		6	1														
588		2															
589		1															
590		2															
591		Int-Egy	104														
592		2	105														
593		dWellmda	dWella														
594		UNRAIL															
595		EQUAL	0														
596		The Deep Well System unavailability															
597		otherwise															
598		1	79														
599		Dummy															
600		RDD															
601		GETHRESH	1	100.0													
602		otherwise No Failure															
603	15 Does the Deep Well System fail due to seismic events?	2 Dwellse	nDwellse														
604																	
605		6	1														
606		2															
607		1															
608		1															
609		External															
610		104	105	102	106	1											
611		dWellmda	dWella	dWella	dWella												
612		UNRAIL															
613		EQUAL	0														
614		Deep Well System unavailable, fails from external event, or falls randomly during period MstMEn															
615		otherwise															
616		1	79														
617		Dummy															
618		RDD															
619		GETHRESH	1	100.0													
620		otherwise No Failure															
621	16 Does the Cooling Tower System fail due to random events?	2 COTRF	nCOTRF														
622																	
623		6	1														
624		2															
625		2	1														
626		2	-9														
627		Int-Egy	/Cotini	46	58												
628		2															
629		Cottmda	Cotta</														

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
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APPENDIX A
ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
849			Int-Equ	79														
850																		
851			Dummy															
852			RDD															
853			THRESH		1	0.000												
854			The Cooling Tower fails randomly															
855				1														
856			62	1.000	0.000													
857			4	1	11	13	17											
858			1	(1 +	1)													
859			External	IRI50	CTCM50	CTCM50												
860				79														
861			Dummy															
862			RDD															
863			THRESH		1	0.000												
864			The Cooling Tower (or a support system) fails from external event															
865				1														
866			62	1.000	0.000													
867			Otherwise															
868				79														
869			Dummy															
870			RDD															
871			GETHRESH		1	100.0												
872			Otherwise No Failure															
873				1														
874			62	0.000	0.000													
875			22 Is the failure of the process steam system an 'accident enabler'?															
876			2	PSIMEN	NPSTIMEN													
877			8		1		2											
878			6															
879			2		1		3											
880			2		2													
881			Int-Equ	PSIMINIT														
882				79														
883			Dummy															
884			RDD															
885			GETHRESH		1	100.0												
886			Failure of the process steam system is an initiator															
887				1														
888			63	0.000	-1.000													
889			2		3		18											
890			(4		+ 1)													
891			IRMINIT		IRMIN													
892				1		79												
893			Dummy															
894			RDD															
895			THRESH		1	0.000												
896			Process Steam fails because of failure of instrument air															
897				1														
898			63	1.000	0.000													
899			2		3		8											
900			(2		+ 1)													
901					NPowInit	NPowEn												

\$Parameter #63, assign value=1.0
if failure of the process steam system is an initiator.

\$Param. # 63 FailPSim

Large comparison parameter forces assignment to branch 2.

Large comparison parameter forces assignment to branch 2.

\$Comparison parameter forces assignment to branch 1.

\$Comparison parameter forces assignment to branch 1.

\$Parameter #62, assign value=1.0

APPENDIX A
WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
902		1	Dummy 79															
903			Add															
904																		
905			THRESH	1	0.0	Comparison parameter will force assignment to branch #1.												
906			Process steam fails because of failure of electric power.															
907		1																
908		63	1.000	0.000														
909		2	1	3		\$Parameter #63,assign value=1.0												
910			2	-3		If failure of the process steam system is an enabler.												
911			Int-Equ /Pstmlnt															
912		2	30	50														
913			Pstlmlda	Pstlmta														
914			UNRAIL															
915			EQUAL	0														
916			The process steam system unavailability															
917		1																
918		63	1.000	0.000		\$Parameter #63,assign value = 1.0												
919			1															
920			1															
921			External															
922		5	38	50	4	76	1											
923			Pstlmlda	Pstlmta	Pstlmtf	Pstlmh	Mstmh											
924			UNRAIL															
925			EQUAL	0														
926			The process steam system is unavailable, falls from external event, or falls randomly during period Mstmh															
927		1																
928		63	1.000	0.000														
929			otherwise															
930		1	79															
931			Dummy															
932			Add															
933			GETHRESH	1	100.0	Large comparison parameter forces assignment to branch 2.												
934			Otherwise No Failure															
935			1															
936		63	0.000	0.000														
937		23 Is the failure of the process cooling water system an accident enabler?																
938			2 PCWH	mPCWH														

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R			
1008			ADD																		
1009			THRESH	1	0.000		\$Comparison parameter forces assignment to branch 1.														
1010			CO2 purge system fails because of failure of electric power																		
1011		1																			
1012		65	1.000	0.000			\$Parameter #65, assign value=1.0														
1013		2	1	3			\$If failure of the carbon dioxide purge is an enabler.														
1014			2	-5																	
1015			Int-Equ	/CO2Init																	
1016		2	40	52																	
1017			CO2Lmda	CO2Tau																	
1018			UNAVAIL																		
1019			EQUAL	0																	
1020			The carbon dioxide purge system unavailability																		
1021		1																			
1022		65	1.000	0.000			\$Parameter #65, assign value=1.0														
1023		1	1																		
1024			1																		
1025			External																		
1026		5	40	52	6	78	1														
1027			CO2Lmda	CO2Tau	CO2Fr	CO2Rn	MstMEx														
1028			UNAVAIL																		
1029			EQUAL	0																	
1030			The carbon dioxide purge system is unavailable, fails from external event, or fails randomly during period MstMEx																		
1031		1																			
1032		65	1.000	0.000																	
1033			Otherwise																		
1034		1	79																		
1035			Dummy																		
1036			ADD																		
1037			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.														
1038			Otherwise	No Failure																	
1039		1																			
1040		65	0.000	0.000																	
1041	25	Is failure of the Air Purge System an 'accident enabler'?																			
1042		2	AirEn	nAirEn																	
1043		8	1	2																	
1044		5																			
1045		2	1	3																	
1046			2	6																	
1047			Int-Equ	AirInit																	
1048		1	79																		
1049			Dummy																		
1050			ADD																		
1051			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.														
1052			Failure of the air purge system is an initiator																		
1053		1																			
1054		66	0.000	-1.000			\$Parameter #66, assign value = negative [-]1.0					\$Param.	# 66	FailAir							
1055		2	3	8			\$If failure of the air purge system is the initiator.														
1056			(2	+ 1)																	
1057			NPowInit	NPowEn																	
1058		1	79																		
1059			Dummy																		
1060			ADD																		

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R				
1061			THRESH	1	0.000		\$Comparison parameter forces assignment to branch 1.															
1062			Air purge system fails because of failure of electric power																			
1063		1																				
1064		66	1.000	0.000			\$Parameter #66 ,assign value=1.0															
1065		2	1	3			\$If failure of the air purge system is an enabler.															
1066			2	-6																		
1067			Int-Egy	/AirInit																		
1068		2	41	53																		
1069			AirLmda	AirTau																		
1070			UAUAIL																			
1071			EQUAL	0																		
1072			The air purge system unavailability																			
1073		1																				
1074		66	1.000	0.000			\$Parameter #66 ,assign value=1.0															
1075		1	1																			
1076			1																			
1077			External																			
1078		5	41	53	7	80	1															
1079			AirLmda	AirTau	AirFr	AirRn	MstMEx															
1080			UAUAIL																			
1081			EQUAL	0																		
1082			The air purge system is unavailable, fails from external event, or fails randomly during period MstMEx																			
1083		1																				
1084		66	1.000	0.000																		
1085			Otherwise																			
1086		1	79																			
1087			Dummy																			
1088			ADD																			
1089			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.															
1090			Otherwise No Failure																			
1091		1																				
1092		66	0.000	0.000																		
1093	26	Is failure of the Nitrogen Storage Tank System an 'accident enabler'?																				
1094		2	N2TkEn	nN2TkEn																		
1095		8	1	2																		
1096		4																				
1097		2	1	3																		
1098			2	7																		
1099			Int-Egy	N2TkInit																		
1100		1	79																			
1101			Dummy																			
1102			ADD																			
1103			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.															
1104			Failure of the nitrogen storage tank system Is an Initiator																			
1105		1																				
1106		67	0.000	-1.000			\$Parameter #67 ,assign value = negative [-]1.0												\$Param.	# 67	FallN2Tk	
1107		2	1	3			\$If failure of the nitrogen storage tank is the Initiator.															
1108			2	-7																		
1109			Int-Egy	/N2TkInit																		
1110		2	42	54																		
1111			N2TkLmda	N2TkTau																		
1112			UAUAIL																			
1113			EQUAL	0																		

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1114			The nitrogen purge system unavailability															
1115		1																
1116		67	1.000	0.000			\$Parameter #67, assign value=1.0											
1117		1	1				\$If failure of the nitrogen storage tank is the enabler.											
1118			1															
1119			External															
1120		5	42	54	8	81	1											
1121			N2TKLmda	N2TKTau	N2TKFr	N2TKRn	MSTmEx											
1122			UNAVAIL															
1123			EQUAL	0														
1124			The nitrogen storage tank system is unavailable, fails from external event, or fails randomly during period MSTmEx															
1125		1																
1126		67	1.000	0.000														
1127			Otherwise															
1128		1	79															
1129			Dummy															
1130			ADD															
1131			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.											
1132			Otherwise No Failure															
1133		1																
1134		67	0.000	0.000														
1135		27	Is failure of the Chilled Water System an 'accident' enabler?															
1136		2	ChWEn	nChWEn														
1137		-8	1	2														
1138		6																
1139		2	1	3														
1140			2	8														
1141			Int-Eqy	ChWInit														
1142		1	79															
1143			Dummy															
1144			ADD															
1145			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.											
1146			Failure of the chilled water system is an Initiator															
1147		1																
1148		68	0.000	-1.000			\$Parameter #1, assign value = negative [-]1.0				\$Param.		# 68	FailChW				
1149		3	3	8	9		\$If failure of the chilled water is an Initiator.											
1150			{ 2	+ 1)	1													
1151			NPowInit	NPowEn	EPowEn													
1152		1	79															
1153			Dummy															
1154			ADD															
1155			THRESH	1	0.000		\$Comparison parameter forces assignment to branch 1.											
1156			The chilled water system fails because of failure of electric power															
1157		1																
1158		68	1.000	0.000			\$Parameter #68, assign value=1.0											
1159		7	3	18	3	19	3	21	20									
1160			{ 4	+ 1	+11	+1)	+ ((9	+ 1)	+ 1)									
1161			IAIrInit	IAIrEn	CTCmInit	CTCmEn	CoTInit	CoTEn	DWElEn									
1162		1	79															
1163			Dummy															
1164			ADD															
1165			THRESH	1	0.000		\$Comparison parameter forces assignment to branch 1.											
1166			The process cooling water system fails because of failure of instrument air or cooling tower															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1220		69	1.888	0.888														
1221			Otherwise	79														
1223			Dummy															
1224			RDD															
1225			GETHRESH	1	100.0													
1226			Otherwise No Failure															
1227		1																
1228		69	0.888	0.888														
1229	29	Is failure of the Bulk Nitrogen System an 'accident enabler'?	2	BIK2NEN	mbikN2EN													
1230																		
1231		8	1															
1232		5																
1233		2	1															
1234			2															
1235			Int-Equ	BIK2Init														
1236		1																
1237			Dummy															
1238			RDD															
1239			GETHRESH	1	100.0													
1240			Failure of the bulk nitrogen system is an initiator															
1241		1																
1242	94	0.888	-1.888															
1243		3	1															
1244			2															
1245			Int-Equ	N2TKInit	N2TKEN													
1246		1																
1247			Dummy															
1248			RDD															
1249			THRESH	1	0.8													
1250			Failure of the Bulk nitrogen system due to Nitrogen Storage Tank system failures.															
1251		1																
1252		94	1.888	0.888														
1253		2	1															
1254			2															
1255			Int-Equ	/BIK2Init														
1256		2	88															
1257			BIK2Lmda	BIK2Tau														
1258			UNUAIL															
1259			EQUAL															
1260			The bulk nitrogen purge system unavailability															
1261		1																
1262		94	1.888	0.888														
1263		1	1				</											

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1326		95	1.000	0.000								\$Param.	# 95	FailCPCN2				
1327		3	1	3	25													
1328			2	(6	+1)													
1329			Int-Egy	AlrInit	AlrEn													
1330		2	91	92														
1331			CPCN2Lmda	CPCN2Tau														
1332			URAIL															
1333			EQUAL	0														
1334			The CPC nitrogen purge system unavailability															
1335		1																
1336		95	1.000	0.000			\$Parameter #95, assign value=1.0					\$Param.	# 95	FailCPCN2				
1337		1	1				\$if failure of the CPC nitrogen is the enabler.											
1338			1															
1339			External															
1340		5	91	92	73	87	1											
1341			CPCN2Lmda	CPCN2Tau	CPCN2Fr	CPCN2Rn	MsTmEx											
1342			URAIL															
1343			EQUAL	0														
1344			The CPC nitrogen system is unavailable, fails from external event, or fails randomly during period MsTmEx															
1345		1																
1346		95	1.000	0.000														
1347			Otherwise															
1348		1	79															
1349			Dummy															
1350			ADD															
1351			GETHRESH	1	100.0		\$Large comparison parameter forces assignment to branch 2.											
1352			Otherwise No Failure															
1353		1																
1354		95	0.000	0.000														
1355	32	Is failure of the LPPP Backup Nitrogen System an 'accident enabler'?																
1356		2	PPN2En	nPPN2En														
1357		8	1	2														
1358		3																
1359		3	1	29	3													
1360			2	(1	+10)													
1361			Int-Egy	BIKN2En	BIKN2Init													
1362		2	114	115														
1363			PPN2Lmda	PPN2Tau														
1364			URAIL															
1365			EQUAL	0														
1366			The CPC nitrogen purge system unavailability															
1367		1																
1368		113	1.000	0.000			\$Parameter #95, assign value=1.0					\$Param.	# 113	FailPPN2				
1369		1	1				\$if failure of the CPC nitrogen is the enabler.											
1370			1															
1371			External															
1372		5	114	115	112	116	1											
1373			PPN2Lmda	PPN2Tau	PPN2Fr	PPN2Rn	MsTmEx											
1374			URAIL															
1375			EQUAL	0														
1376			The CPC nitrogen system is unavailable, fails from external event, or fails randomly during period MsTmEx															
1377		1																
1378		113	1.000	0.000														

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1379			Otherwise															
1380		1	79															
1381			Dummy															
1382			ADD															
1383			GETHRESH	1	100.0													
1384			Otherwise No Failure															
1385		1																
1386		113	0.000	0.000														
1387	33		Is failure of the SPC N2 System an 'accident enabler'?															
1388		2	SPCN2En	nSPCN2En														
1389		8	1	2														
1390		4																
1391		2	1	26														
1392			2	1														
1393			Int-Equ	N2TkEn														
1394		1	79															
1395			Dummy															
1396			ADD															
1397			THRESH	1	0.0													
1398			Failure of the SPC nitrogen system due to Nitrogen Storage Tank system failures.															
1399		1																
1400		118	1.000	0.000									\$Param.	# 118	FallSPCN2			
1401		1	1															
1402			2															
1403			Int-Equ															
1404		2	119	120														
1405			SPCN2Lmda	SPCN2Tau														
1406			UNAVAIL															
1407			EQUAL	0														
1408			The SPC nitrogen purge system unavailability															
1409		1																
1410		118	1.000	0.000														
1411		1	1															
1412			1															
1413			External															
1414		5	119	120	117	121	1											
1415			SPCN2Lmda	SPCN2Tau	SPCN2Fr	SPCN2Rn	MstmEn											
1416			UNAVAIL															
1417			EQUAL	0														
1418			The SPC nitrogen system is unavailable, fails from external event, or fails randomly during period MstmEn															
1419		1																
1420		118	1.000	0.000														
1421			Otherwise															
1422		1	79															
1423			Dummy															
1424			ADD															
1425			GETHRESH	1	100.0													
1426			Otherwise No Failure															
1427		1																
1428		118	0.000	0.000														
1429	34		Is the failure of the SPC Seismic trigger System an 'accident enabler'?															
1430		2	STrigEn	nSTrigEn														
1431		8	1	2														

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1485			1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1486		2																
1487		70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1488		71	-10.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
1489	37	Do the cell covers over the Salt Process Cell dislodge and fall because of a seismic event?																
1490		2	ISCuSels	nISCuSel														
1491		6	1	2														
1492		2																
1493		1	2															
1494			2															
1495			E1-Sels															
1496		1	33															
1497			CCouFr															
1498			ADD															
1499			EQUAL	0														
1500		Probability of Salt Process Cell Covers failing is placed in branch 1, remainder in branch 2.																
1501			Otherwise															
1502		1	79															
1503			Dummy															
1504			ADD															
1505			GETHRESH	1	100.0													
1506		Large comparison parameter forces assignment to branch 2, nocovers fail.																
1507	38	Does a cell cover fail while being moved by the crane?																
1508		2	CDCuSPC	nCDCuSPC														
1509		2	1	2														
1510		2																
1511		2	1	6														
1512			5	2														
1513			LtdCD	CraneDrop														
1514			1.000	0.000														
1515			Otherwise															
1516			0.000	1.000														
1517	39	Do the cell covers that fall in a crane accident strike a tank?																
1518		14	No_HIT	CD_Prn	CD_Oev	CD_DECT	CD_PAFT	CD_PABT	CD_SME	CD_SART	CD_ACT	CD_MFT	CD_MEL	CD_PPPT	CD_PPST	CD_PPRT		
1519		2	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
1520		2																
1521		1	38															
1522			1															
1523			CDCuSPC															
1524			0.074600	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.03050	0.03050	0.03050		
1525			Otherwise															
1526			1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
1527	40	Do the cell covers that fall in a seismic event strike the PR?																
1528		2	SCu-PR	nSCu-PR														
1529		2	1	2														
1530		2																
1531		2	2	37														
1532			2	1														
1533			E1-Sels	ISCuSels														
1534			0.010	0.990														
1535			Otherwise															
1536			0.000	1.000														
1537	41	Does a Seismic event or cover crane fall rupture and spill the contents of the Precipitate Reactor in the Salt Process Cell?																

UFUN-PRS will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event.

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1591			Otherwise															
1592		1	79															
1593			Dummy															
1594			ADD															
1595			GETHRESH	1	100.0													
1596			Large comparison parameter forces assignment to branch 2, no explosive concentration															
1597	43	Does a damaging deflagration/detonation occur in the Precipitate Reactor?																
1598		3	PRH-Def	PRH-Def	nPRH-Exp													
1599		2	1	2	3													
1600		4																
1601		1	42															
1602			2															
1603			nCon-PRH															
1604			0.000	0.000	1.000													
1605		1	41															
1606			1															
1607			Rpt-PRH															
1608			0.000	0.000	1.000													
1609		2	42	41														
1610			1	2														
1611			Con-PRH	nRpt-PRH														
1612			0.001	0.999	0.000													
1613			Otherwise															
1614			0.000	0.000	1.000													
1615	44	Do the cell covers that fall in a seismic event strike the OE?																
1616		2	SCU-OEU	nSCU-OEU														
1617		2	1	2														
1618		2																
1619		2	2	37														
1620			2	1														
1621			E1-Sels	fSCuSels														
1622			0.010	0.990														
1623			Otherwise															
1624			0.000	1.000														
1625	45	Does a Seismic event or cover crane fail rupture and spill the contents of the Organic Evaporator in the Salt Process Cell?																
1626		2	RptOEU	nRptOEU														
1627		6	1	2														
1628		3																
1629		2	44	39														
1630			1	+3														
1631			SCU-OEU	CD_Oeu														
1632		1	79															
1633			Dummy															
1634			ADD															
1635			THRESH	1	0.00													
1636			Comparison parameter forces assignment to branch 1, cell covers strike then tank ruptured.															
1637		3	2	37	44													
1638			2	(2	+ 2)													
1639			E1-Sels	nfSCuSel	nSCU-OEU													
1640		1	21															
1641			OEU-Fr															
1642			ADD															
1643			EQUAL	0														

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ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

1644	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1644			Probability of rupture of Organic Evaporator is placed in branch 1, remainder in branch 2.															
1645			Otherwise	1	79													
1646			Dummy															
1647			RDD															
1648			GETHRESH	1	100.0													
1649			Large comparison parameter forces assignment to branch 2, no seismic event, no rupture of tank.															
1651	46	Does an explosive concentration accumulate in Organic Evaporator Tank?	2 Con-DEU	nCon-DEU	2													
1652																		
1653	6			1	2													
1654	4			1														
1655	2																	
1656			(-1)															
1657			/External	/Int-Egy														
1658	1			79														
1659			Dummy															
1660			RDD															
1661			GETHRESH	1	100.0													
1662			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
1663	1			2														
1664			Int-Egy															
1665																		
1666	7		FailNFWr	FailCO2	65	69	70	71	98	118								
1667			FUN-DEU															
1669			EQUAL															
1670			UFUN-DEU will calculate probability of explosive concentration in the Organic Evaporator Tank.															
1671	1			1														
1672																		
1673			External															
1674	6			70	71	98	118	135	136									
1675			MissTime	nComm1	LHS	FailSPCN2	FailTrig	FailUPS										
1676			FUN-DEUS															
1677			EQUAL															
1678			UFUN-DEUS will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event.															
1679			Otherwise															
1680	1			79														
1681			Dummy															
1682			RDD															
1683			GETHRESH	1	100.0													
1684			Large comparison parameter forces assignment to branch 2, no explosive concentration															
1685	47	Does a detonation/detonation of the Organic Evaporator tank occur?	3 DEU-DE1	DEU-DE1	2	3												
1686																		
1687	2			1	2				</									

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1697		2	46	45														
1698			1	2														
1699			Con-OECT	nRptOECT														
1700			0.001	0.999	0.000													
1701			Otherwise															
1702			0.000	0.000	1.000													
1703	48	Do the cell covers that fail in a seismic event strike the OECT?																
1704		2	SCu-OECT	nSCu-OECT														
1705		2	1	2														
1706		2																
1707		2	2	37														
1708			2	1														
1709			E1-Sels	fSCuSels														
1710			0.010	0.990														
1711			Otherwise															
1712			0.000	1.000														
1713	49	Does a Seismic event or cover crane fail rupture and spill the contents of the Organic Evaporator Condensate Tank in the Salt Process Cell?																
1714		2	RptOECT	nRptOECT														
1715		6	1	2														
1716		3																
1717		2	48	39														
1718			1	+4														
1719			SCu-OECT	CD_OECT														
1720		1	79															
1721			Dummy															
1722			ADD															
1723			THRESH	1	0.00													
1724		Comparison parameter forces assignment to branch 1, cell covers strike then tank ruptured.																
1725		3	2	37	48													
1726			2	(2	+ 2)													
1727			E1-Sels	nfSCuSel	nSCu-OECT													
1728		1	22															
1729			OECTFr															
1730			ADD															
1731			EQUAL	0														
1732		Probability of rupture of Organic Evaporator Condensate Tank is placed in branch 1, remainder in branch 2.																
1733			Otherwise															
1734		1	79															
1735			Dummy															
1736			ADD															
1737			GETHRESH	1	100.0													
1738		Large comparison parameter forces assignment to branch 2, no Seismic event, no rupture of tank.																
1739	58	Does an explosive concentration accumulate in Organic Evaporator Condensate Tank?																
1740		2	Con-OECT	nCon-OECT														
1741		6	1	2														
1742		4																
1743		2	1	1														
1744			(-1	-2)														
1745			/External	/Int-Equ														
1746		1	79															
1747			Dummy															
1748			ADD															
1749			GETHRESH	1	100.0													

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1750	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
1750																			
1751			1																
1752			2																
1753			Int-Egy																
1754		7	FailNFW	FailCO2	FailBCO2	MissTime	nComm1	LHS	FailSPCN2										
1755																			
1756			FUN-OECT																
1757			EQUH																
1758			FUN-OECT																
1759			FUN-OECT																
1760																			
1761			External																
1762		6																	
1763			MissTime	nComm1	LHS	FailSPCN2	FailTrig	FailUps											
1764			FUN-OECTS																
1765			EQUH																
1766			FUN-OECTS																
1767			otherwise																
1768		1																	
1769			Dummy																
1770			ADD																
1771			GETRESH	1															
1772																			
1773																			
1774			3 OECT-Det	OECT-Det	OECT-EM														
1775			2	1															
1776		4																	
1777		1	50																
1778			2																
1779			nCon-OECT																
1780			0.000	0.000															
1781		1	49																
1782			1																
1783			RpIOECT																
1784			0.000	0.000															
1785		2	50																
1786			1																
1787			Con-OECT	RpIOECT															
1788			0.001	0.999	0.000														
1789			otherwise																
1790			0.000	0.000															
1791			0.000	0.0															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2015		3	2	56	61													
2016			2	(2	+ 2)													
2017			E1-Sels	nCCuSel	nCCu-SME													
2018		1	25															
2019			SME-Fr															
2020			ADD															
2021			EQUAL	0														
2022			Probability of the rupture of the Slurry Mix Evaporator Tank is placed in branch 1, remainder in branch 2.															
2023			Otherwise															
2024		1	79															
2025			Dummy															
2026			ADD															
2027			GETHRESH	1	100.0													
2028			Large comparison parameter forces assignment to branch 2, no Seismic event, no rupture of tank.															
2029	63	Does an explosive concentration accumulate in the Slurry Mix Evaporator Tank (SME)?																
2030		2	ConSME	nConSME														
2031		6	1	2														
2032		5																
2033		2	1	1														
2034			(-1	-2)														
2035			/External	/Int-Egy														
2036		1	79															
2037			Dummy															
2038			ADD															
2039			GETHRESH	1	100.0													
2040			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
2041		2	1	3														
2042			2	7														
2043			Int-Egy	N2TkInit														
2044		1	79															
2045			Dummy															
2046			ADD															
2047			GETHRESH	1	100.0													
2048			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
2049		1	1															
2050			2															
2051			Int-Egy															
2052	14	60	61	64	66	67	62	70	71	90	95	103	98	93	100			
2053		FallNPwr	FallEPwr	FallPCW	FallAIR	FallN2TK	FallCoT	MissTime	nCommI	LHS	FallCPCN2	FallBWel	FallCTCm	FallAIR	FallCPCTk			
2054		FUN-SME																
2055		EQUAL	0															
2056		UFUN-SME will calculate probability of explosive concentration in the Slurry Mix Evaporator Tank.																
2057		1	1															
2058			1															
2059			External															
2060	8	60	66	67	70	71	90	95	100									
2061		FallNPwr	FallAIR	FallN2TK	MissTime	nCommI	LHS	FallCPCN2	FallCPCTk									
2062		FUN-SMES																
2063		EQUAL	0															
2064		UFUN-SMES will calculate probability of explosive concentration when failure of the Indicated support systems is caused by an external event.																
2065			Otherwise															
2066		1	79															
2067			Dummy															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2068			ADD															
2069			GETHRESH	1	100.0													
2070			Large comparison parameter forces assignment to branch 2, no explosive concentration															
2071	64		Does a detonation/deflagration occur in the Slurry Mix Evaporator Tank (SME)?															
2072		3	SME-Det	SME-Def	nSME-Eh													
2073		2	1	2	3													
2074		4																
2075		1	65															
2076			2															
2077			nConSME															
2078			0.000	0.000	1.000													
2079		1	62															
2080			1															
2081			RptSME															
2082			0.000	0.000	1.000													
2083		2	63	62														
2084			1	2														
2085			ConSME	nRptSME														
2086			0.001	0.999	0.000													
2087			Otherwise															
2088			0.000	0.000	1.000													
2089	65		Do the cell covers that fall in a seismic event strike the SRAT?															
2090		2	CCu-SRAT	nCCu-SRAT														
2091		2	1	2														
2092		2																
2093		2	2	56														
2094			2	1														
2095			E1-Sels	nCCuSels														
2096			0.010	0.990														
2097			Otherwise															
2098			0.000	1.000														
2099	66		Does a Seismic event or cover crane fail rupture and spill the contents of the Sludge Receipt and Adjustment Tank in the Chemical Process Cell?															
2100		2	RptSRAT	nRptSRAT														
2101		6	1	2														
2102		3																
2103		2	65	39														
2104			1	+8														
2105			CCu-SRAT	CCu-SRAT														
2106		1	79															
2107			Dummy															
2108			ADD															
2109			THRESH	1	0.0													
2110			Comparison parameter forces assignment to branch 1; cell cover strike, then tank ruptured.															
2111		3	2	56	65													
2112			2	(2	+2)													
2113			E1-Sels	nCCuSel	nCCu-SRAT													
2114		1	27															
2115			SRATFr															
2116			ADD															
2117			EQUAL	0														
2118			Probability of the rupture of Sludge Receipt and Adjustment Tank is placed in branch 1, remainder in branch 2.															
2119			Otherwise															
2120		1	79															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2121			Dummy															
2122			ADD															
2123			GETHRESH	1	100.0													
2124			Large comparison parameter forces assignment to branch 2, no Seismic event, no rupture of tank.															
2125	67		Does an explosive concentration accumulate in the Sludge Receipt and Adjustment Tank (SRAT)?															
2126		2	ConsSRAT	nConsSRAT														
2127		6	1	2														
2128		5																
2129		2	1	1														
2130			(-1	-2)														
2131			/External	/Int-Equ														
2132		1	79															
2133			Dummy															
2134			ADD															
2135			GETHRESH	1	100.0													
2136			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
2137		2	1	3														
2138			2	7														
2139			Int-Equ	N2TKInit														
2140		1	79															
2141			Dummy															
2142			ADD															
2143			GETHRESH	1	100.0													
2144			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
2145		1	1															
2146			2															
2147			Int-Equ															
2148		15	60	61	63	64	66	67	62	70	71	98	95	103	98	93	108	
2149			FailNPwr	FailEPwr	FailPSIm	FailPCW	FailAIR	FailN2TK	FailCoT	MissTime	nCommf	LHS	FailCPCN2	FailDWel	FailCTCm	FailAIR	FailCPTK	
2150			FUN-SRAT															
2151			EQUAL	0														
2152			UFUN-SRAT will calculate probability of explosive concentration in the vapor space of the Sludge Receipt and Adjustment Tank.															
2153		1	1															
2154			1															
2155			External															
2156		9	60	66	67	70	71	98	95	108								
2157			FailNPwr	FailAIR	FailN2TK	MissTime	nCommf	LHS	FailCPCN2	FailCPTK								
2158			FUN-SRATS															
2159			EQUAL	0														
2160			UFUN-SRATS will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event.															
2161			Otherwise															
2162		1	79															
2163			Dummy															
2164			ADD															
2165			GETHRESH	1	100.0													
2166			Large comparison parameter forces assignment to branch 2, no explosive concentration															
2167	68		Does a detonation/deflagration occur in the Sludge Receipt and Adjustment Tank (SRAT)?															
2168		3	SRAT-Def	SRAT-Def	nSRAT-Ex													
2169		2	1	2	3													
2170		4																
2171		1	67															
2172			2															
2173			nConsSRAT															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2280		8	68	66	67	78	71	98	95	188								
2281			FailNPwr	FailAIR	FailN2Tk	MissTime	nCommI	LHS	FailCPCN2	FailCPCTK								
2282			FUN-MFT															
2283			EQUAL	0														
2284			UFUN-MFT will calculate probability of explosive concentration in the Melter Feed Tank.															
2285		1	1															
2286			1															
2287			External															
2288		8	68	66	67	78	71	98	95	188								
2289			FailNPwr	FailAIR	FailN2Tk	MissTime	nCommI	LHS	FailCPCN2	FailCPCTK								
2290			FUN-MFTS															
2291			EQUAL	0														
2292			UFUN-MFTS will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event.															
2293			Otherwise															
2294		1	79															
2295			Dummy															
2296			ADD															
2297			GETHRESH	1	100.0													
2298			Large comparison parameter forces assignment to branch 2, no explosive concentration															
2299	74	Does a detonation/deflagration occur in the Melter Feed Tank (MFT)?																
2300		3	MFT-Det	MFT-Def	nMFT-Ex													
2301		2		1	2	3												
2302		4																
2303		1	73															
2304			2															
2305			nConMFT															
2306			0.000	0.000	1.000													
2307		1	72															
2308			1															
2309			Rpt-MFT															
2310			0.000	0.000	1.000													
2311		2	73	72														
2312			1	2														
2313			ConMFT	nRpt-MFT														
2314			0.001	0.999	0.000													
2315			Otherwise															
2316			0.000	0.000	1.000													
2317	75	Does a damaging explosion occur in the Salt Process Cell Vent System (SPCU)?																
2318		2	SPCU-Exp	nSPCU-Ex														
2319		2		1	2													
2320		4																
2321		1	37															
2322			1															
2323			fSCuSels															
2324			0.000	1.000														
2325		4	43	47	51	55												
2326			(1	+ 1	+ 1	+ 1)												
2327			PRN-Det	OEU-Det	OECT-Det	PAFT-Det												
2328			1.000	0.000														
2329		4	43	47	51	55												
2330			(2	+ 2	+ 2	+ 2)												
2331			PRN-Def	OEU-Def	OECT-Def	PAFT-Def												
2332				0.000														

WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2598			0.001	0.999	0.000													
2599			Otherwise															
2600			0.000	0.000	1.000													
2601	85	Does an explosive concentration accumulate in Precipitate Reactor Feed Tank?																
2602		2	ConPFT2	nConPFT														
2603		6	1	2														
2604		4																
2605		2	1	1														
2606			(-1	-2)														
2607			/External	/Int-Equ														
2608		1	79															
2609			Dummy															
2610			ADD															
2611			GETHRESH	1	100.0													
2612		Large comparison parameter forces assignment to branch 2, no explosive concentration.																
2613		1	1															
2614			2															
2615			Int-Equ															
2616		7	60	65	69	70	71	90	110									
2617			FailNPwr	FailC02	FailBC02	MissTime	nCommI	LHS	FailSPCN2									
2618			FUN-PRFTI															
2619			EQUAL	0														
2620		UFUN-PRFTI will calculate probability of explosive concentration in the Precipitate Reactor Feed Tank-no Ignit source.																
2621		1	1															
2622			1															
2623			External															
2624		6	70	71	90	110	135	136										
2625			MissTime	nCommI	LHS	FailSPCN2	FailTrig	FailUPS										
2626			FUN-PRFTSI															
2627			EQUAL	0														
2628		UFUN-PRFTSI will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event-no Ignit source.																
2629			Otherwise															
2630		1	79															
2631			Dummy															
2632			ADD															
2633			GETHRESH	1	100.0													
2634		Large comparison parameter forces assignment to branch 2, no explosive concentration																
2635	86	Does a detonation/deflagration occur in the Precipitate Reactor Feed Tank?																
2636		3	PRFT02Det	PRFT02Def	nPRFT-Exp													
2637		2	1	2	3													
2638		6																
2639		1	55															
2640			1															
2641			PRFT-Det															
2642			0.000	0.000	1.000													
2643		1	55															
2644			2															
2645			PRFT-Def															
2646			0.000	0.000	1.000													
2647		1	85															
2648			2															
2649			nConPRFT															
2650			0.000	0.000	1.000													

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2784	2783	2782	2781	2780	2779	2778	2777	2776	2775	2774	2773	2772	2771	2770	2769	2768	2767	2766	2765	2764	2763	2762	2761	2760	2759	2758	2757	2756	2755	2754	2753	2752	2751	2750	2749	2748	2747	2746	2745	2744	2743	2742	2741	2740	2739	2738	2737	2736	2735	2734	2733	2732	2731	2730	2729	2728	2727	2726	2725	2724	2723	2722	2721	2720	2719	2718	2717	2716	2715	2714	2713	2712	2711	2710	2709	2708	2707	2706	2705	2704	2703	2702	2701	2700	2699	2698	2697	2696	2695	2694	2693	2692	2691	2690	2689	2688	2687	2686	2685	2684	2683	2682	2681	2680	2679	2678	2677	2676	2675	2674	2673	2672	2671	2670	2669	2668	2667	2666	2665	2664	2663	2662	2661	2660	2659	2658	2657	2656	2655	2654	2653	2652	2651	2650	2649	2648	2647	2646	2645	2644	2643	2642	2641	2640	2639	2638	2637	2636	2635	2634	2633	2632	2631	2630	2629	2628	2627	2626	2625	2624	2623	2622	2621	2620	2619	2618	2617	2616	2615	2614	2613	2612	2611	2610	2609	2608	2607	2606	2605	2604	2603	2602	2601	2600	2599	2598	2597	2596	2595	2594	2593	2592	2591	2590	2589	2588	2587	2586	2585	2584	2583	2582	2581	2580	2579	2578	2577	2576	2575	2574	2573	2572	2571	2570	2569	2568	2567	2566	2565	2564	2563	2562	2561	2560	2559	2558	2557	2556	2555	2554	2553	2552	2551	2550	2549	2548	2547	2546	2545	2544	2543	2542	2541	2540	2539	2538	2537	2536	2535	2534	2533	2532	2531	2530	2529	2528	2527	2526	2525	2524	2523	2522	2521	2520	2519	2518	2517	2516	2515	2514	2513	2512	2511	2510	2509	2508	2507	2506	2505	2504	2503	2502	2501	2500	2499	2498	2497	2496	2495	2494	2493	2492	2491	2490	2489	2488	2487	2486	2485	2484	2483	2482	2481	2480	2479	2478	2477	2476	2475	2474	2473	2472	2471	2470	2469	2468	2467	2466	2465	2464	2463	2462	2461	2460	2459	2458	2457	2456	2455	2454	2453	2452	2451	2450	2449	2448	2447	2446	2445	2444	2443	2442	2441	2440	2439	2438	2437	2436	2435	2434	2433	2432	2431	2430	2429	2428	2427	2426	2425	2424	2423	2422	2421	2420	2419	2418	2417	2416	2415	2414	2413	2412	2411	2410	2409	2408	2407	2406	2405	2404	2403	2402	2401	2400	2399	2398	2397	2396	2395	2394	2393	2392	2391	2390	2389	2388	2387	2386	2385	2384	2383	2382	2381	2380	2379	2378	2377	2376	2375	2374	2373	2372	2371	2370	2369	2368	2367	2366	2365	2364	2363	2362	2361	2360	2359	2358	2357	2356	2355	2354	2353	2352	2351	2350	2349	2348	2347	2346	2345	2344	2343	2342	2341	2340	2339	2338	2337	2336	2335	2334	2333	2332	2331</
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2969			PRBT@2Det	SME@2Det	SRAT@2Det	MFT@2Det												
2970			1.000	0.000														
2971		4	88	90	92	94												
2972			(2	+2	+2	+2)												
2973			PRBT@2Det	SME@2Det	SRAT@2Det	MFT@2Det												
2974			1.000	0.000														
2975			Otherwise															
2976			0.000	1.000														
2977	97	Does an energetic event in the SPC fail the removable wall between the SPC and the CPC?																
2978		2	FailWall	nFailWal														
2979		2	1	2														
2980		2																
2981		2	86	55														
2982			1	+1														
2983			PRFT@2Det	PRFT-Def														
2984			0.500	0.500														
2985			Otherwise															
2986			0.000	1.000														
2987	98	Do the cell covers for the Chemical Process Cell dislodge and fail following an energetic event?																
2988		2	CPCovFI	nCPCovFI														
2989		2	1	2														
2990		5																
2991		10	78	60	64	68	74	88	98	92	94	56						
2992			2	3	3	3	3	3	3	3	3	2						
2993			nPUUH-EH	nPRBT-EH	nSME-EH	nSRAT-EH	nMFT-EH	nPRBT-EH	nSME-EH	nSRAT-EH	nMFT-EH	nICCuSel						
2994			0.000	1.000														
2995		1	56															
2996			1															
2997			ICCuSels															
2998			0.000	1.000														
2999		8	60	64	68	74	60	64	68	74								
3000			1	+1	+1	+1	+2	+2	+2	+2								
3001			PRBT-Def	SME-Def	SRAT-Def	MFT-Def	PRBT-Def	SME-Def	SRAT-Def	MFT-Def								
3002			1.000	0.000														
3003		9	78	88	90	92	94	88	98	92	94							
3004			1	+1	+1	+1	+1	+2	+2	+2	+2							
3005			PUUH-Def	PRBT@2Det	SME@2Det	SRAT@2Det	MFT@2Det	PRBT@2Det	SME@2Det	SRAT@2Det	MFT@2Det							
3006			1.000	0.000														

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
3340		1	79															
3341			Dummy															
3342			ADD															
3343			GETHRESH	1	100.0													
3344			Large comparison parameter forces assignment to branch 2, no Seismic event, no collapse of ultrification building.															
3345	111	Does the Sand Filter function following a seismic event?																
3346		2	fSndFit	nfSndFit														
3347		6	1	2														
3348		2																
3349		1	2															
3350		2																
3351			E1-Seis															
3352		1	14															
3353			FINFr															
3354			ADD															
3355			EQUAL	0														
3356			Probability of Sand Filter failure is placed in branch 1, remainder in branch 2.															
3357			Otherwise															
3358		1	79															
3359			Dummy															
3360			ADD															
3361			GETHRESH	1	100.0													
3362			Large comparison parameter forces assignment to branch 2, no Seismic event, no failure of the sand filter.															
3363	112	Do the Building Exhaust Ducts from Zone 1 to the Sand Filter function following a seismic event?																
3364		2	failDuct	nfailDct														
3365		6	1	2														
3366		3																
3367		2	2	110														
3368		2	1															
3369			E1-Seis	UB-Clpse														
3370		1	79															
3371			Dummy															
3372			ADD															
3373			THRESH	1	0.00													
3374			Comparison parameter forces assignment to branch 1, if building collapses then failure of exhaust ducts.															
3375		2	2	110														
3376		2	2															
3377			E1-Seis	nUB-Clps			</											

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
3393		4	1	3	8	9												
3394			2	((2	+1)	1)												
3395			Int-Equ	NPowInit	NPowEn	EPowEn												
3396		1	79															
3397			Dummy															
3398			ADD															
3399			THRESH	1	0.0													
3400			Comparison parameter will force assignment to branch #1, fans fail because of loss of power.															
3401		1																
3402		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3403		5	1	1	1	8	9											
3404			(3	+5	+4)	1	1											
3405			LtdLeak	LtdCD	LtdMisc	NPowEn	EPowEn											
3406		1	79															
3407			Dummy															
3408			ADD															
3409			THRESH	1	0.0													
3410			Comparison parameter will force assignment to branch #1, fans fail because of loss of power.															
3411		1																
3412		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3413		6	1	3	8	9	3	18										
3414			2	(2	+1)	(2	-4	2)										
3415			Int-Equ	NPowInit	NPowEn	nEPowEn	/IAirInit	nIAirEn										
3416		2	44	56														
3417			FanLmda1	FanTau1														
3418			UNAVAIL															
3419			EQUAL	0														
3420			Unavailability of Zone 1 exhaust fans															
3421		1																
3422		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3423		6	1	1	1	8	9	18										
3424			(4	+3	+5)	1	(2	2)										
3425			LtdMisc	LtdLeak	LtdCD	NPowEn	nEPowEn	nIAirEn										
3426		2	44	56														
3427			FanLmda1	FanTau1														
3428			UNAVAIL															
3429			EQUAL	0														
3430			Unavailability of															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
3446		2	124	125														
3447			FanLmda2	FanTau2														
3448			UNRAIL															
3449			EQUAL	0														
3450			Unavailability of Zone 1 exhaust fans															
3451		1																
3452		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3453		4	1	1	1	1												
3454			2	+3	+4	+5												
3455			Int-Egy	LtdLeak	LtdMisc	LtdCO												
3456		2	126	127														
3457			FanLmda3	FanTau3														
3458			UNRAIL															
3459			EQUAL	0														
3460			Unavailability of Zone 1 exhaust fans															
3461		1																
3462		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3463		3	1	0	9													
3464			1	1	1													
3465			External	NPowEn	EPowEn													
3466		1	79															
3467			Dummy															
3468			ADD															
3469			THRESH	1	0.0													
3470			Comparison parameter will force assignment to branch #1, fans fail because of loss of power.															
3471		1																
3472		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3473		4	1	0	9	10												
3474			1	1	2	2												
3475			External	NPowEn	nEPowEn	nIAirEn												
3476		5	44	56	16	96	1											
3477			FanLmda1	FanTau1	FanFr	FanRn1	MsTmEx											
3478			UNRAIL															
3479			EQUAL	0														
3480			Unavailability of Zone 1 exhaust fans, from external event, or randomly during period MsTmEx															
3481		1																
3482		128	1.000	0.000			\$Parameter #128, assign value = 1.0					\$Param.	# 128	FallFan				
3483		4	1	0	9	10												

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
3552			0.000	1.000														
3553		1	114															
3554			1															
3555			SPCDefOP															
3556			1.000	0.000														
3557			Otherwise															
3558			0.000	1.000														
3559	116	Do the cell covers for the Salt Process Cell dislodge after the overpressurization deflagration?																
3560		2	SPCuFI@2	nSPCuFI														
3561		2	1	2														
3562		3																
3563		1	105															
3564			1															
3565			SPCuFI															
3566			0.000	1.000														
3567		1	115															
3568			1															
3569			SPC-Def1															
3570			1.000	0.000														
3571			Otherwise															
3572			0.000	1.000														
3573	117	Does splashing (spillage) of the Precipitate Reactor contents occur?																
3574		2	PRX-Spl2	nPRX-Spl2														
3575		2	1	2														
3576		3																
3577		1	106															
3578			1															
3579			PRX-Spl															
3580			0.000	1.000														
3581		1	116															
3582			1															
3583			SPCuFI@2															
3584			0.100	0.900														
3585			Otherwise															
3586			0.000	1.000														
3587	118	Does splashing (spillage) of the contents of the Organic Evaporator tank occur?																
3588		2	OEU-Spl2	nOEU-Spl2														
3589		2	1	2														
3590		3																
3591		1	107															
3592			1															
3593			OEU-Spl															
3594			0.000	1.000														
3595		1	116															
3596			1															
3597			SPCuFI@2															
3598			0.100	0.900														
3599			Otherwise															
3600			0.000	1.000														
3601	119	Does splashing (spillage) of the contents of the Organic Evaporator Condensate tank occur?																
3602		2	OECT-Spl2	nOECT-Spl2														
3603		2	1	2														
3604		3																

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	M	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
3764		3	OEUF3Det	OEUF3Det	OEUF3Det													
3765		2	1	2	3													
3766		7																
3767		2	47	82														
3768			1	+1														
3769			OEUF-Det	OEUF2Det														
3770		2	8.888	47	82	1.888												
3771			2	2	+2													
3772			OEUF-Det	OEUF2Det														
3773			OEUF-Det	OEUF2Det														
3774		1	8.888	8.888	1.888													
3775			2	81														
3776			nCon-DEU															
3777			OEUF-Det	OEUF2Det														
3778		1	8.888	45		1.888												
3779			1															
3780			Rp10EU															
3781																		
3782			8.888	107	118	1.888												
3783		2	1	+1														
3784			OEUF-Spl	OEUF-Spl2														
3785			8.888	8.888	1.888													
3786			8.888	121	81													
3787		2	1															
3788			SPC-Det2	Con-DEU2														
3789			8.881	8.999	8.888													
3790			otherwise															
3791			8.888	8.888	1.888													
3792																		
3793	125		Does a detonation/degradation of the Organic Evaporator Condensate tank occur?															
3794		2	1	2	3													
3795																		
3796		7																
3797		2	51	84														
3798			OEUF-Det	OEUF2Det														
3799			OEUF-Det	OEUF2Det														
3800		2	8.888	8.888	1.888													
3801			2	51	84													
3802			2	+2														
3803			OEUF-Det	OEUF2Det														
3804			8.888	8.888	1.888													
3805		1	83															
3806			2															
3807			nCon-DECT															
3808			8.888	8.888	1.888													
3809		1	49															
3810			1															
3811			Rp10ECT															
3812			8.888	8.888	1.888													
3813		2	188	119														
3814			1	+1														
3815			OECT-Spl	OECT-Spl2														
3816			8.888	8.888	1.888													

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
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4029		2	74	94														
4030			2	+2														
4031			MFT-Def	MFT@2Def														
4032			0.000	0.000	1.000													
4033		1	93															
4034			2															
4035			nConMFT															
4036			0.000	0.000	1.000													
4037		1	72															
4038			1															
4039			Rpt-MFT															
4040			0.000	0.000	1.000													
4041		1	103															
4042			1															
4043			MFT-Spl															
4044			0.000	0.000	1.000													
4045		2	105	116														
4046			1	+1														
4047			SPCouFI	SPCouFI@2														
4048			0.000	0.000	1.000													
4049		3	93	72	129													
4050			1	2	1													
4051			ConMFT2	nRpt-MFT	PVVH-BT2													
4052			0.001	0.999	0.000													
4053			Otherwise															
4054			0.000	0.000	1.000													
4055	134	Does a detonation occur in the CPC Vent system?																
4056		2	CPCU-Exp1	nCPCU-Ex														
4057		2	1	2														
4058		4																
4059		1	98															
4060			1															
4061			CPCouFI															
4062			0.000	1.000														
4063		2	105	116														
4064			1	+1														
4065			SPCouFI	SPCouFI@2														
4066			0.000	1.000														
4067		0	133	132	131	130	133	132	131	130								
4068			1	+1	+1	+1	+2	+2	+2	+2								
4069			MFT@3Def	SRAT@3Def	SME@3Def	PABT@3Def	MFT@3Def	SRAT@3Def										

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
4082			1															
4083			PRBT@3Det															
4084			0.500	0.500														
4085			Otherwise															
4086			0.000	1.000														
4087	136	Does splashing (spillage) of the Precipitate Reactor contents occur?																
4088		2	PRH-Spl3	nPRH-Spl														
4089		2	1	2														
4090		9																
4091		1	41															
4092			1															
4093			Rpt-PRH															
4094			0.000	1.000														
4095		2	106	117														
4096			1	+1														
4097			PRH-Spl	PRH-Spl2														
4098			0.000	1.000														
4099		5	123	128	41	135	124											
4100			3	2	2	2	3											
4101			nPRH-Exp	nSPCuFI	nRpt-PRH	nFallWal	nOEU-Exp											
4102			0.000	1.000														
4103		1	123															
4104			1															
4105			PRH@3Det															
4106			1.000	0.000														
4107		2	120	124														
4108			1	1														
4109			SPCuFI@3	OEU@3Det														
4110			0.500	0.500														
4111		2	120	124														
4112			1	2														
4113			SPCuFI@3	OEU@3Def														
4114			0.200	0.000														
4115		1	120															
4116			1															
4117			SPCuFI@3															
4118			0.100	0.900														
4119		1	135															
4120			1															
4121			FallWall2															
4122			0.100	0.900														
4123			Otherwise</															

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4135			OEU-Spl	OEU-Spl2														
4136			0.000	1.000														
4137		6	124	128	45	135	123	125										
4138			3	2	2	2	3	3										
4139			nOEU-Exp	nSPCovFI	nRptOEU	nFallWal	nPRH-Exp	nOECT-Ex										
4140			0.000	1.000														
4141		1	124															
4142			1															
4143			OEU@3Det															
4144			1.000	0.000														
4145		3	128	123	125													
4146			1	(1	+1)													
4147			SPCuFI@3	PRH@3Det	OECT@3Det													
4148			0.500	0.500														
4149		3	128	123	125													
4150			1	(2	+2)													
4151			SPCuFI@3	PRH@3Def	OECT@3Def													
4152			0.200	0.800														
4153		1	128															
4154			1															
4155			SPCuFI@3															
4156			0.100	0.900														
4157		1	135															
4158			1															
4159			FallWall2															
4160			0.100	0.900														
4161			Otherwise															
4162			0.000	1.000														
4163	138	Does splashing (spillage) of the contents of the Organic Evaporator Condensate tank occur?																
4164		2	OECT-Spl3	nOECT-Spl														
4165		2	1	2														
4166		9																
4167		1	49															
4168			1															
4169			RptOECT															
4170			0.000	1.000														
4171		2	100	119														
4172			1	+1														
4173			OECT-Spl	OECT-Spl2														
4174			0.000	1.000														
4175		6	125															

ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

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4480	R	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
4480			0.200	0.000														
4481		1	141															
4482			1															
4483			CPCouf@2															
4484			0.100	0.900														
4485		1	140															
4486			1															
4487			fallwall															
4488			0.100	0.900														
4489			otherwise															
4490			0.000	1.000														
4411	146	Does splashing (spillage) of the Melted Feed Tank contents occur?	2 MFT-Spl2	MFT-Spl														
4412			2	1														
4413			2	1														
4414		7																
4415		1	72															
4416			1															
4417			Rpt-MFT															
4418		1	0.000	1.000														
4419		1	103															
4420			1															
4421			MFT-Spl															
4422			0.000	1.000														
4423		4	141	72	140	133												
4424			2	2	2													
4425			nCPCouf1	nRpt-MFT	nFallwall	nMFT-Ex												
4426			0.000	1.000														
4427		1	133															
4428			1															
4429			MFT@3Det															
4430			1.000	0.000														
4431		1	141															
4432			1															
4433			CPCouf@2															
4434			0.100	0.900														
4435		1	140															
4436			1															
4437			fallwall															
4438			0.100	0.900														
4439			otherwise															
4440			0.000	1.000														
147	Does a degradation in the SPC lead to a degradation in the RPC that damages the building?	2 UB-Cipse2	nUB-Cipse2	2														
4441			2	1														
4442			2	1														
4443			2	1														
4444		3																
4445		1	110															
4446			1															
4447			UB-Cipse															
4448			0.000	1.000														
4449		8	1															
4450			(1)															
4451			Int-Equ	+2)														
4452			0.900	0.100														

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ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

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4665			M06-Det															
4666			0.000	1.000														
4667		1	155															
4668			1															
4669			MEL-Exp															
4670			1.000	0.000														
4671			Otherwise															
4672			0.000	1.000														
4673	157	Does splashing (spillage) of the Melter contents occur as the result of energetic events in the Melter Cell?																
4674		4	tMSpl/06	pMSpl/06	Mlt-06	nMltRise												
4675		2	1	2	3	4												
4676		9																
4677		2	1	4														
4678			(3 2)															
4679			LtdLeak	MltR-Leak														
4680			0.000	0.010	0.990	0.000												
4681		2	150	2														
4682			1	2														
4683			RptMelt	E1-Sels														
4684			1.000	0.000	0.000	0.000												
4685		2	151	2														
4686			1	2														
4687			RptMag	E1-Sels														
4688			0.000	0.000	1.000	0.000												
4689		1	156															
4690			1															
4691			MCouFal															
4692			0.000	0.010	0.990	0.000												
4693		1	39															
4694			11															
4695			CO_MEL															
4696			0.000	0.010	0.990	0.000												
4697		1	155															
4698			1															
4699			MEL-Exp															
4700			0.000	0.010	0.990	0.000												
4701		1	153															
4702			1															
4703			M06-Det															
4704			0.000	0.000	1.000	0.000												
4705		2	1															

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4718		1	31															
4719			OWSTFr															
4720			ADD															
4721			EQUAL	0														
4722			Probability of rupture of the Organic Waste Storage Tank is placed in branch 1, remainder in branch 2.															
4723		1	2															
4724			3															
4725			E2-Wind															
4726		1	31															
4727			OWSTFr															
4728			ADD															
4729			EQUAL	0														
4730			Fragility of the Organic Waste Storage Tank is placed in branch 1, remainder in branch 2.															
4731			Otherwise															
4732		1	79															
4733			Dummy															
4734			ADD															
4735			GETHRESH	1	100.0													
4736			Large comparison parameter forces assignment to branch 2, no seismic event, no rupture of tank.															
4737	159		Does an explosive concentration accumulate in the Organic Waste Storage Tank?															
4738		2	ConOWST	nConOWST														
4739		6	1	2														
4740		4																
4741		2	1	1														
4742			(-1	-2)														
4743			/External	/Int-Equ														
4744		1	79															
4745			Dummy															
4746			ADD															
4747			GETHRESH	1	100.0													
4748			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
4749		1	1															
4750			2															
4751			Int-Equ															
4752		7	69	61	67	94	78	71	98									
4753			FallNPwr	FallEPwr	FallN2TK	FallBIK2	MissTime	nCommI	LHS									
4754			FUN-OWST															
4755			EQUAL	0														
4756			UFUN-OWST															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
4877			FailN2TK	MissTime	nComm1	LHS	FailBIKN2	FailPPN2										
4878			FUN-PPPT															
4879			EQUAL	0														
4880			UFUN-PPPT will calculate probability of explosive concentration in the Low Point Pump Pit Precipitate Tank.															
4881		1	1															
4882			1															
4883			External															
4884		6	67	70	71	90	94	113										
4885			FailN2TK	MissTime	nComm1	LHS	FailBIKN2	FailPPN2										
4886			FUN-PPPTS															
4887			EQUAL	0														
4888			UFUN-PPPTS will calculate probability of explosive concentration when failure of the indicated support systems is caused by a seismic event.															
4889			Otherwise															
4890		1	79															
4891			Dummy															
4892			ADD															
4893			GETHRESH	1	100.0													
4894			Large comparison parameter forces assignment to branch 2, no explosive concentration															
4895	166	Does a damaging detonation/deflagration occur in the Precipitate tank in the Low Point Pump Pit?																
4896		3	PPPTDel	PPPTDel	nPPPTExp													
4897		2	1	2	3													
4898		4																
4899		1	165															
4900			2															
4901			nConPPPT															
4902			0.000	0.000	1.000													
4903		1	164															
4904			1															
4905			RuptPPT															
4906			0.000	0.000	1.000													
4907		2	165	164														
4908			1	2														
4909			ConPPPT	nRuptPPT														
4910			0.001	0.999	0.000													
4911			Otherwise															
4912			0.000	0.000	1.000													
4913	167	Does splashing (spillage) of the Pump Pit Precipitate Tank contents occur?																
4914		2	PPPTS															

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
4930		0.888	1.888														
4931	168	Does an explosive concentration accumulate in Pump Pit Precipitate Tank Cell?															
4932	2	nCompPC															
4933	6	1	2														
4934	4																
4935	2	1	1														
4936		(-1)	(-2)														
4937		/External /Int-Equ															
4938	1	79															
4939		Dummy															
4940		ADD															
4941		GETHRESH	1	108.8													
4942		Large comparison parameter forces assignment to branch 2, no explosive concentration.															
4943	1	1															
4944	2																
4945		Int-Equ															
4946	7	68	61	78	71	98	67	94									
4947		FallNPwr	FallNPwr	Misstime	nComml	LHS	FallNZTK	FallBKNZ									
4948		FUN-PPC															
4949		EQUIL	8														
4950		FUN-PPC will calculate probability of explosive concentration in the Low Point Pump Cell.															
4951	1	1															
4952		1															
4953		External															
4954	7	68	61	78	71	98	67	94									
4955		FallNPwr	FallNPwr	Misstime	nComml	LHS	FallNZTK	FallBKNZ									
4956		FUN-PPCS															
4957		EQUIL	8														
4958		FUN-PPCS will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event.															
4959		otherwise															
4960	1	79															
4961		Dummy															
4962		ADD															
4963		GETHRESH	1	108.8													
4964		Large comparison parameter forces assignment to branch 2, no explosive concentration															
4965	169	Does a damaging detonation/deflagration occur in the Pump Pit Precipitate Tank Cell?															
4966	3	ppCdet	ppCdet	ppCdet	ppCdet	ppCdet											
4967	2	1	2														
4968	3																

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
5036			ADD															
5037			EQUAL	8														
5038			Probability of rupture of Pump Pit Sludge Tank is placed in branch 1, remainder in branch 2.															
5039			Otherwise															
5040		1	79															
5041			Dummy															
5042			ADD															
5043			GETHRESH	1	100.0													
5044			Large comparison parameter forces assignment to branch 2, no seismic event, no rupture of tank.															
5045	173		Does an explosive concentration accumulate in Pump Pit Sludge Tank?															
5046		2	ConPPST	nConPPST														
5047		6	1	2														
5048		4																
5049		2	1	1														
5050			(-1	-2)														
5051			/External	/Int-Equ														
5052		1	79															
5053			Dummy															
5054			ADD															
5055			GETHRESH	1	100.0													
5056			Large comparison parameter forces assignment to branch 2, no explosive concentration.															
5057		1	1															
5058			2															
5059			Int-Equ															
5060		8	68	61	78	71	98	113	67	94								
5061			FallNPwr	FallEPwr	MissTime	nComm1	LHS	FallPPN2	FallN2Tk	FallBIK2								
5062			FUN-PPST															
5063			EQUAL	8														
5064			UFUN-PPST will calculate probability of explosive concentration in the Pump Pit Sludge Tank.															
5065		1	1															
5066			1															
5067			External															
5068		6	78	71	98	113	67	94										
5069			MissTime	nComm1	LHS	FallPPN2	FallN2Tk	FallBIK2										
5070			FUN-PPST															
5071			EQUAL	8														
5072			UFUN-PPST will calculate probability of explosive concentration when failure of the indicated support systems is caused by an external event.															
5073			Otherwise															

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
5301		2	1	4														
5302			(3	4)														
5303			LtdLeak	PP-Offlow														
5304			1.000	0.000														
5305			Otherwise															
5306			0.000	1.000														
5307	188	Does a leak occur in the Chemical Process Cell?																
5308		2	CPCLeak	nCPCLeak														
5309		2	1	2														
5310		2																
5311		2	1	4														
5312			(3	5)														
5313			LtdLeak	CPC-Leak														
5314			1.000	0.000														
5315			Otherwise															
5316			0.000	1.000														
5317	189	Does a leak of process material occur in the Salt Process Cell?																
5318		2	SPCLeak	nSPCLeak														
5319		2	1	2														
5320		2																
5321		2	1	4														
5322			(3	6)														
5323			LtdLeak	SPC-Leak														
5324			1.000	0.000														
5325			Otherwise															
5326			0.000	1.000														
5327	190	Does a leak of benzene occur in the Salt Process Cell?																
5328		2	BnzLeak	nBnzLeak														
5329		2	1	2														
5330		2																
5331		2	1	4														
5332			(3	10)														
5333			LtdLeak	BZ-Leak														
5334			1.000	0.000														
5335			Otherwise															
5336			0.000	1.000														
5337	191	Does an incidental leak occur in the Pump Pits?																
5338		2	LPPLeak	nLppLeak														
5339		2	1	2														

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5354			1.000	0.000														
5355			Otherwise															
5356			0.000	1.000														
5357	193		What is the status of the ventilation for the Low Point Pump Pit Building?															
5358		4	PPnFn/Br	PPnF/nBr	PPFan/Br	LPPVent												
5359		2	1	2	3	4												
5360		7																
5361		2	2	2														
5362			(2	+ 3)														
5363			E1-Sels	E2-Wind														
5364			1.000	0.000	0.000	0.000												
5365		8	166	166	169	169	170	3	8	9								
5366			(((1	+ 2	+ 1	+ 2)	1)	((2	+ 1)	1))								
5367			PPPTDet	PPPTDef	PPPCDet	PPPCDef	PPPCov	NPowInit	NPowEn	EPowEn								
5368			1.000	0.000	0.000	0.000												
5369		8	174	174	177	177	178	3	8	9								
5370			(((1	+ 2	+ 1	+ 2)	1)	((2	+ 1)	1))								
5371			PPSTDet	PPSTDef	PPSCDet	PPSCDef	PPSCov	NPowInit	NPowEn	EPowEn								
5372			1.000	0.000	0.000	0.000												
5373		3	3	8	9													
5374			((2	+ 1)	1)													
5375			NPowInit	NPowEn	EPowEn													
5376			0.000	1.000	0.000	0.000												
5377		5	166	166	169	169	170											
5378			(((1	+ 2	+ 1	+ 2)	1)											
5379			PPPTDet	PPPTDef	PPPCDet	PPPCDef	PPPCov											
5380			0.000	0.000	1.000	0.000												
5381		5	174	174	177	177	178											
5382			(((1	+ 2	+ 1	+ 2)	1)											
5383			PPSTDet	PPSTDef	PPSCDet	PPSCDef	PPSCov											
5384			0.000	0.000	1.000	0.000												
5385			Otherwise															
5386			0.000	0.000	0.000	1.000												
5387	193																	
5388																		
5389																		
5390																		
5391																		
5392																		

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
5460			1															
5461			LPPLeak															
5462	1	3	187															
5463			1															
5464			LPP-OuFI															
5465	3	4	181	191	187													
5466			2	2	2													
5467			nPPRTSpl	nLppLeak	nLPPOuFI													
5468																		
5469	8	8	PRH-Det	PRH-Def	PRH-Spl	PRH-Leak	PRH-Uent	PRH-UcR	PRH-OuFI	nPRH-Rel		\$Precipitate Reactor Tank				5		
5470	3	1	43	80	123													
5471			1	+1	+1													
5472			PRH-Det	PRH@2Det	PRH@3Det													
5473	3	2	43	80	123													
5474			2	+2	+2													
5475			PRH-Def	PRH@2Def	PRH@3Def													
5476	4	3	186	117	136	147												
5477			1	+1	+1	+1												
5478			PRH-Spl	PRH-Spl2	PRH-Spl3	UB-Clipse2												
5479	1	4	189															
5480			1															
5481			SPCLEak															
5482	3	5	75	95	127													
5483			1	+1	+1													
5484			SPCU-Exp	SPCU-Exp2	SPCU-Exp3													
5485	1	6	183															
5486			1															
5487			UcRH-SPC															
5488	1	7	185															
5489			1															
5490			SPCOuFI															
5491	12	8	43	80	123	186	117	136	147	75	127	189	185	183				
5492			3	3	3	2	2	2	2	2	2	2	2	2				
5493			nPRH-Exp	nPRH-Exp	nPRH-Exp	nPRH-Spl	nPRH-Spl2	nPRH-Spl	nUB-Clips2	nSPCU-Ex	nSPCU-Ex	nSPCLEak	nSPCOuFI	nUcRH-SPC				
5494																		
5495	7	7	PRFTDet	PRFTDef	PRFTSpl	PRFTLeak	PRFTUent	PRFTOuFI	nPRFTRel			\$Precipitate Reactor Feed Tank				6		
5496	3	1	55	86	126													
5497			1	+1	+1													
5498			PRFT-Det	PRFT@2Det	PRFT@3Det													
5499	3	2	55	86	12													

ACCIDENT PROGRESSION EVENT TREE FOR DEFENSE WASTE PROCESSING FACILITY - MODE C - PRODUCTION VERSION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
5513			SPC00FI															
5514	11	7	55	86	126	189	128	139	147	75	127	189	185					
5515			3	3	3	2	2	2	2	2	2	2	2					
5516			nPRFT-Exp	nPRFT-Exp	nPRFT-Exp	nPRFT-Spl	nPRFT-Spl	nPRFT-Spl	nUB-Clps2	nSPCU-Ex	nSPCU-Ex	nSPCLeak	nSPC00FI					
5517																		
5518	7	7	PRBT-Def	PRBT-Def	PRBT-Spl	PRBTLeak	PRBTUent	PRBT00FI	nPRBTRel			\$Precipitate Reactor Bottoms Tank			7			
5519	3	1	68	88	138													
5520			1	+1	+1													
5521			PRBT-Def	PRBT@2Def	PRBT@3Def													
5522	3	2	68	88	138													
5523			2	+2	+2													
5524			PRBT-Def	PRBT@2Def	PRBT@3Def													
5525	3	3	99	142	147													
5526			1	+1	+1													
5527			PRBT-Spl	PRBT-Spl2	UB-Clpse2													
5528	1	4	188															
5529			1															
5530			CPCLeak															
5531	3	5	76	96	134													
5532			1	+1	+1													
5533			CPCU-Exp	CPCU-Exp2	CPCU-Exp1													
5534	1	6	184															
5535			1															
5536			CPC00FI															
5537	18	7	68	88	138	99	142	147	76	134	188	184						
5538			3	3	3	2	2	2	2	2	2	2						
5539			nPRBT-Ex	nPRBT-Ex	nPRBT-Ex	nPRBT-Spl	nPRBT-Spl	nUB-Clps2	nCPCU-Ex	nCPCU-Ex	nCPCLeak	nCPC00FI						
5540																		
5541	8	8	SME-Def	SME-Def	SME-Spl	SME-Leak	SME-Uent	SME-UcRH	SME-00FI	nSME-Rel		\$Slurry Mix Evaporator Tank			8			
5542	3	1	64	98	131													
5543			1	+1	+1													
5544			SME-Def	SME@2Def	SME@3Def													
5545	3	2	64	98	131													
5546			2	+2	+2													
5547			SME-Def	SME@2Def	SME@3Def													
5548	3	3	188	143	147													
5549			1	+1	+1													
5550			SME-Spl	SME-Spl2	UB-Clpse2													
5551	1	4	188															
5552			1															
5553			CPCLeak															
5554	3	5	76	96	134													
5555			1	+1	+1													
5556			CPCU-Exp	CPCU-Exp2	CPCU-Exp1													
5557	1	6	182															
5558			1															
5559			UcRH-CPC															
5560	1	7	184															
5561			1															
5562			CPC00FI															
5563	11	8	64	98	131	188	143	147	76	134	188	184	182					
5564			3	3	3	2	2	2	2	2	2	2	2					
5565			nSME-Ex	nSME-Ex	nSME-Ex	nSME-Spl	nSME-Spl	nUB-Clps2	nCPCU-Ex	nCPCU-Ex	nCPCLeak	nCPC00FI	nUcRH-CPC					

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
5619			ACT-Spl	ACT-Spl2	UB-Clpse2													
5620	1	2	188															
5621			1															
5622			CPCLeak															
5623	3	3	76	96	134													
5624			1	+1	+1													
5625			CPCU-Exp	CPCU-Exp2	CPCU-Exp1													
5626	1	4	182															
5627			1															
5628			UcRH-CPC															
5629	1	5	184															
5630			1															
5631			CPCOufl															
5632	8	6	182	145	147	76	134	188	184	182								
5633			2	2	2	2	2	2	2	2								
5634			nRCT-Spl	nRCT-Spl	nUB-Clps2	nCPCU-Ex	nCPCU-Ex	nCPCLeak	nCPCOufl	nUcRH-CPC								
5635																		
5636	5	5	TMitRise	pMitRise	MitO6Ris	Can_Rupt	nMeltRel					\$Melter				12		
5637	2	1	157	147														
5638			1	+1														
5639			lMSpl/06	UB-Clpse2														
5640	1	2	157															
5641			2															
5642			pMSpl/06															
5643	1	3	157															
5644			3															
5645			Mit-06															
5646	1	4	192															
5647			1															
5648			CanRpt															
5649	3	5	157	192	147													
5650			4	2	2													
5651			nMitRise	nCanRpt	nUB-Clps2													
5652																		
5653	2	2	SPC-Def	nSPCDef								\$Salt Process Cell Deflagration				13		
5654	1	1	121															
5655			1															
5656			SPC-Def2															
5657	1	2	121															
5658			2															
5659			nSPCDef2															
5660				</														

APPENDIX A

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
5672			CPCouFI	CPCouFI@2	UB-Clpse2													
5673	3	2	98	141	147													
5674			2	2	2													
5675			nCPCouFI	nCPCouFI	nUB-Clps2													
5676																		
5677	2	2	SPCCuFI	nSPCCuFI														
5678	3	1	185	116	128													
5679			1	+1	+1													
5680			SPCouFI	SPCouFI@2	SPCouFI@3													
5681	3	2	185	116	128													
5682			2	2	2													
5683			nSPCouFI	nSPCouFI	nSPCouFI													
5684																		
5685	2	2	MCBlown	nMCBlown														
5686	1	1	156															
5687			1															
5688			MCouFal															
5689	1	2	156															
5690			2															
5691			nMCouFal															
5692																		
5693	5	5	Collapse	nFanBrch	BrFn/FIt	nFn/nFIt	Fan/FIt											
5694	2	1	118	147														
5695			1	+1														
5696			UB-Clpse	UB-Clpse2														
5697	4	2	118	113	111	-112												
5698			(1	(1	+1	+1))												
5699			UB-Clpse	Fan-Fall	fSndFIt	fallDuct												
5700	4	3	118	113	111	112												
5701			1	2	2	2												
5702			UB-Clpse	nFanFall	nfSndFIt	nfallDct												
5703	4	4	118	113	111	112												
5704			2	(1	+1	+1)												
5705			nUB-Clps	Fan-Fall	fSndFIt	fallDuct												
5706	5	5	118	147	112	113	111											
5707			2	2	2	2	2											
5708			nUB-Clps	nUB-Clps2	nfallDct	nFanFall	nfSndFIt											
5709																		
5710	4	4	nFanBrch	nFn/nBrch	Fan/Brch	LPPVent												
5711	1	1	193															
5712			1															