

Kouts



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Department of Nuclear Energy

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January 28, 1983

Mr. Melvin Silberberg
Chief, Fuel Behavior Branch
Division of Accident Evaluation
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mel:

Attached are my comments on Draft NUREG-0956, subsequent
to the peer review meeting of January 25 and 26, 1983.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Herb'.

Herbert Kouts
Chairman

Attachment

HK:ns

8507130012 850425
PDR FOIA
ALVAREZ85-110 PDR

Comments on Draft NUREG-0956

by

Herbert Kouts

The draft of NUREG-0956 shows a substantial amount of thought devoted to the source term, beyond previous work on the subject. Though the remarks I make below are generally on lines critical of the draft, I do not wish to give the impression that I reject the draft or that I do not respect the quality of work that went into it. Rather, I am only commenting on ways by which the work might be further improved.

1. It is important to stand back from the draft and view it as a whole. It generated a great deal of opposition and adverse comment at the peer review meeting. Let me put in my words what I feel was the cause of the reaction. The analysis done for WASH-1400 neglected attenuation of the source term through plateout and deposition of aerosols in the primary system, except for some isolated BWR sequences that were not discussed in the present version of the draft NUREG-0956. The analysis for WASH-1400 also included assumptions as to chemical forms of cesium and iodine that have since undergone change: cesium was assumed to be released in elemental form, as was iodine except for a small organic iodine contribution. The new analysis considers the two bound in CsOH and CsI.

When the new analysis takes all this into account, for some sequences it arrives at the same numerical results on source term as WASH-1400. There was a general feeling that this result violates common sense, and so there was a struggle over the two-day period to see how this might have been the result of assumptions made, method of analysis, or method of interpretation.

2. I am one of those who felt that the lack of change of some of the numbers was not believable. I felt that the ability to understand the result was hampered by the method of development. It did not appear to be physically real, but had more of the character of numbers plugged into codes, leading to generation of other numbers, without physical or chemical solidity. What was there about the physical and chemical models that made the result come out this way? What is the sensitivity of the results to input assumptions? I particularly felt the need for mass balances and energy balances, to lay a basis for physical insight. I also suspect that many parts of the calculation are amenable to analytic treatment, and do not require computer treatment. I know of no better way to build insight and intuition than analytic calculations.

A better physical and chemical understanding might lead to important changes in emphasis and results.

3. The draft report verifies that delay in containment failure reduces the source term. There is no apparent attention paid to the effects of water or the effects of oxydation - reduction conditions. It can be argued (and was argued at the peer review meeting) that there is no such thing as a completely dry accident at a PWR. The original primary system water would profoundly affect the source term through generating a very wet containment through which fission products must move in AB, S₂D, or TMLB' events, and having a similar effect in the auxiliary building in V events. I believe this is true. The assumption that in some sequences the fission products go instantaneously from the primary system to the outside environment is reminiscent of WASH-740, and is certainly non-physical.

4. I believe that if the analysis is to be concentrated on a few low-probability, high-consequence sequences, its name should be changed. The name implies a study of the source term without it being clear that the analysis is confined to extreme situations.

5. A strong effort must be made to reconcile highly disparate views of the source term being generated in several places. An early meeting is needed at which the different groups tell what they are doing and what they are finding out. The source of differences in results must be worked out and understood. At the end, it will not be necessary that all parties agree, but it will be necessary that they understand the reasons for any remaining differences.

DISP / SER
PETRANGELI

COMITATO NAZIONALE PER L'ENERGIA NUCLEARE

TELEGRAMMA - TELEX - FONOGRAMMA (*)

*World Data Base
entered into own
records.*

1. 1. 1

Posiz. SC

Destinatario: M. SILBERBERG

NRC - WASHINGTON D.C. - USA

Mittente: DISP/SER

(TELEX 7108240412)

4513

TESTO: Prot. n.

IN COMPLIANCE WITH DEAD LINE FEB. 3RD I AM SUBMITTING YOU SOME WRITTEN COMMENTS ON NUREG 0956 DRAFT. THEY ARE STILL TO BE CONSIDERED AS QUICK REACTIONS TO DRAFT AND MEETING.

THE DRAFT REPORT IS CONSIDERED BY ME AND BY COLLEAGUES AT DISP A REMARKABLE ADVANCEMENT IN EVALUATION TECHNIQUES AND DATA. IT IS VERY USEFUL TO US ALSO AS IT IS NOW AS A REFERENCE TECHNICAL DOCUMENT.

HOWEVER IT IS MY IMPRESSION THAT SOME REFINEMENT AND SUPPLEMENT COULD IN A SHORT TIME BRING IT TO THE LEVEL AND IMPORTANCE OF AN UPTODATED BEST ESTIMATE SOURCE TERM EVALUATION FOR A TYPICAL PWR. FOLLOWING COMMENTS ARE AN ATTEMPT TO GIVE A CONSTRUCTIVE CONTRIBUTION TO THIS END..

IN THE FUTURE, WITH INCREASING AVAILABILITY OF EXPERIMENTAL AND ANALYTICAL DATA, UNCERTAINTY MARGINS COULD ALSO BE DEFINED IN ORDER TO GIVE TO THE RESULTS WIDER MEANING AND APPLICABILITY (GENERALIZED SOURCE TERM DEFINITION).

*Need data
uncertainty*

Nel caso di motivi personali compilare quanto segue:

TIPO SA	MATRICOLA	CODICE	DESCRIZIONE	IMPORTO	TOTALE	MESE
61		303	TELEGRAMMI PERSONALI			
1 2	3 7	8 10	11 30	43 48	43 48	79 80

DA COMPILARE SOLO PER TELEGRAMMI PERSONALI

Trasmesso da:

CSY/SER

11. 92

Preparata da:

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COMITATO NAZIONALE PER L'ENERGIA NUCLEARE

TELEGRAMMA - TELEX - FONOGRAMMA (*)

Posiz.

Destinatario:

Mittente:

TESTO: Prot. n.

*Retention in RPS
Deposition in Buildings] Best estimate
Presence of water
Containment failure] Conservative*

FOUR ITEMS ARE GENERALLY ADVOCATED AS LEADING TO LOWER AND MORE REALISTIC RELEASES THAN WASH 1400 ONES: RETENTION IN RPS; DEPOSITION IN CONTAINMENT AND IN OTHER BUILDINGS; PRESENCE OF WATER (IN PIPES, TANKS, PONDS, ATMOSPHERE); TIME AND MODE OF CONTAINMENT FAILURE. IT SEEMS TO ME THAT THE FIRST TWO ITEMS HAVE BEEN DEALT WITH IN THE DRAFT USING A "BEST ESTIMATE" APPROACH WHILE THE LAST TWO (WATER AND CONTAINMENT FAILURE) ARE APPROACHED WITH A "CONSERVATIVE" ATTITUDE.

IT SEEMS TO ME THAT, IN ORDER TO COMPLY WITH THE "BEST ESTIMATE" GENERAL CHARTER OF THE REPORT, "MOST LIKELY" OR "MEDIAN PROBABILITY" PLANT EVENTS SHOULD BE ASSUMED INSTEAD OF "WORST RESPONSE" EVENTS, AT ANY DECISION STEP WITHIN EACH SEQUENCE. THE INITIAL DECISION OF REFERRING TO WASH 1400 DOMINANT SEQUENCES DEFINES THE GENERAL PROBABILITY LEVEL (I. E. THE DEGREE OF CONSERVATISM) AT WHICH THE "BEST ESTIMATE" SOURCE TERM IS BEING, BY CHOICE, EVALUATED. (IN THIS RESPECT, HOWEVER, THE INCLUSION OF

AS SEEMS OVERLY CONSERVATIVE DUE TO ITS VERY LOW PROBABILITY).

Nel caso di motivi personali compilare quanto segue:

TIPO SX	MATRICOLA	CODICE	DESCRIZIONE	IMPORTO	TOTALE	MESE
6.1		303	TELEGRAMMI PERSONALI			
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DA COMPIRE SOLO PER TELEGRAMMI PERSONALI

Trasmesso da:

COMITATO NAZIONALE PER L'ENERGIA NUCLEARE

TELEGRAMMA - TELEX - FONOGRAMMA (*)

Posiz:

Destinatario:

Mittente:

TESTO: Prot. n.

THEREFORE THERE IS NO NEED TO CHOOSE ADDITIONAL CONSERVATIVE ASSUMPTIONS ON PLANT BEHAVIOUR IN THE DETAILED STUDY OF THE CONSEQUENCES OF EACH SEQUENCE. THIS SUBJECT MIGHT REQUIRE A CLARIFICATION OF MANDATE ON YOUR PART.

AS AN EXAMPLE, IN TMLB, THE BEST ESTIMATE APPROACH SUGGEST THE ASSUMPTION THAT PUMP SEALS FAIL WITHIN MINUTES AFTER LOSS OF ELECTRIC POWER IN MOST PWRs (BUT I DONT KNOW THE DETAILS OF SURRY SEALS).

THIS ASSUMPTION, NOT EXPLORED IN THE DRAFT REPORT, MIGHT TEND TO ATTENUATE THE CALCULATED CONSEQUENCES.

THIS "BEST ESTIMATE" ASSUMPTION SEEMS TO HAVE THE SAME BASIS AS THE ASSUMING, IN AN INTERFACE V LOCA, THAT THE LOW PRESSURE SYSTEM BREAKS WHEN PUMP IN COMMUNICATION WITH THE HIGH PRESSURE SYSTEM, BECAUSE IT IS NOT DESIGNED FOR SUCH A PRESSURE.

IN GENERAL TERMS, IT SEEMS TOME THAT WE SHOULD NOT REFUSE TO TRY TO IMPROVE SEQUENCE EVALUATIONS OVER WASH 1400 ONES, GIVEN THE

ADDITIONAL EXPERIENCE AND THOUGHT NOW AVAILABLE.

Nel caso di motivi personali compilare quanto segue:

TIPO SR	MATRICOLA	CODICE	DESCRIZIONE	IMPORTO	TOTALE	MESE
61		303	TELEGRAMMI PERSONALI			
1 2	3 7	8 10	11 30	43 48	43 48	79 80

DA COMPILARE SOLO PER TELEGRAMMI PERSONALI

Trasmesso da:



COMITATO NAZIONALE PER L'ENERGIA NUCLEARE

TELEGRAMMA - TELEX - FONOGRAMMA (*)

Posiz.

Destinatario :

Mittente :

TESTO : Prot. n.

IN THIS EFFORT, IT WOULD PERHAPS BE USEFUL TO MAKE AVAILABLE, TO THE REPORT DRAFTING ACTIVITY, THE SUPPORT OF PEOPLE INVOLVED IN STUDIES ON CONTAINMENT RESPONSE UNDER SEVERE ACCIDENT CONDITIONS (NRC RESEARCH PROGRAMS; ZION AND I P ANALYSIS) AND ON PLANT SYSTEMS BEHAVIOUR IN DEGRADED SITUATIONS (BEST ESTIMATE OF WATER INVENTORY AND LOCATION; STRUCTURAL LIMITS OF PLANT COMPONENTS).

IN PARTICULAR, CRITICAL SEQUENCES SUGGESTED ITEMS FOR FURTHER WORK (IN BRACKETS) MIGHT BE: AB BETA AND V (AEROSOL DEPOSITION IN AUXILIARY BUILDING, SEE HOSEMAN KFK REPORT GAITHERSBURG 1982; AB NOT A RISK DOMINANT SEQUENCE; RISK DOMINANT CHARACTER OF V SEQUENCE BEING SPECIFIC TO SURRY 1 PLANT AND NOT A GENERAL PWR FEATURE) AND TMLB GAMMA (CONTAINMENT RESISTENCE TO PRESSURE SPIKE POSSIBLY AIDED BY FAILURE OF PUMP SEALS).

IT SEEMS AT FIRST GLANCE, BUT I MAY BE WRONG, THAT WORK IN THESE AREAS AND ALONG THESE LINES MIGHT BRING ABOUT A FACTOR OF TEN TO ONE HUNDRED IN THE OVERALL CALCULATED SOURCE TERM.

Nel caso di motivi personali compilare quanto segue:

TIPO SX	MATRICOLA	CODICE	DESCRIZIONE	IMPORTO	TOTALE	MESE
6.1		303	TELEGRAMMI PERSONALI			
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DA COMPILARE SOLO PER TELEGRAMMI PERSONALI

Trasmesso da :



COMITATO NAZIONALE PER L'ENERGIA NUCLEARE
TELEGRAMMA - TELEX - FONOGRAMMA (*)

Posiz.

Destinatario :

Mittente :

TESTO : Prot. n.

I SHALL SEND YOU BY MAIL MY INFORMATION MATERIAL ON PUMP SEAL
FAILURE, SHOULD IT BE OF SOME USE.

I SEND YOU MY BEST REGARDS AND I THANK YOU AGAIN FOR YOUR
INVITATION IN THE PEER REVIEW MEETING. PLEASE, LET ME KNOW IF I
CAN BE OF OF SOME HELP IN THE WORK. YOURS

PETRANGELI

ENEA-DISP-ROMA

Petrangeli

Nel caso di motivi personali compilare quanto segue :

TIPO SR	MATRICOLA	CODICE	DESCRIZIONE	IMPORTO	TOTALE	MESE
6.1		303	TELEGRAMMI PERSONALI			
1 2	3 7	8 10	11 30	43 48	43 48	79 80

DA COMPILARE SOLO PER TELEGRAMMI PERSONALI

Trasmesso da :

NRC BHD WSH

BHD WSH

610183 ENEA I

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610183 ENEA I

TELEX NR.2446

MEL SILBERBERG

TELEX 7108240412

SUBJECT: SOURCE TERM REPORTS PEER REVIEW. IN THE FOLLOWING SOME NOTES AND REMARKS ARE LISTED AS A CONSEQUENCE OF THE SECOND PEER REVIEW MEETING OF MAY 24 AND 25. FIRST OF ALL LET ME EXPRESS YOU AGAIN THE APPRECIATION OF MY ORGANIZATION FOR INVITING US IN THE REVIEW ACTIVITIES. I WANT ALSO TO TELL YOU THAT THE INFORMATION AND RESULTS PRODUCED BY NRC AND BY ITS CONTRACTORS IN THE COURSE OF THE WORK ARE EXTREMELY USEFUL TO US IN OUR EFFORT TO ACQUIRE THE MOST UP TO DATE METHODS FOR SEVERE ACCIDENTS SOURCE TERMS EVALUATIONS. IN THIS FRAME, IT SEEMS TO ME THAT VOLUME 2 OF BMI 2104 MARKS A PROGRESS OVER VOLUME 1 BECAUSE IN VARIOUS POINTS IT UNDERSCORES THE IMPORTANCE OF A CAREFUL EVALUATION OF PLANT PHENOMENA LIKE PENETRATION BEHAVIOUR BESIDES FISSION PRODUCT CHEMICAL-PHYSICAL PHENOMENA. I AM CONFIDENT THAT UNDER THE

RECTION OF YOUR NRC OFFICES, THE FINAL PRODUCT OF THE SOURCE TERM REASSESSMENT ACTIVITY WILL IN DUE TIME BUILD UP TO A COMPLETE PACKAGE OF REFERENCE INFORMATION AND EVALUATION RESULTS SUCH TO BE OF GUIDANCE IN US AND ABROAD FOR REALISTIC YET CAUTIONS EVALUATIONS OF SOURCE TERMS. I ADD SOME GENERAL AND SPECIFIC NOTES AND REMARKS IN ORDER TO CONTRIBUTE TO THE BEST I CAN IN THIS EFFORT. THE FOLLOWING FACTS, RESULTING FROM THE STUDIES AND THE DISCUSSIONS, SHOULD FIRSTLY BE ACKNOWLEDGED. ACCIDENT SEQUENCES AS IDENTIFIED BY WASH 1400 DON'T GIVE PER SE ENOUGH INPUT DATA FOR FISSION PRODUCT CALCULATIONS: FURTHER ASSUMPTIONS: EITHER CONSERVATIVE OR BEST-ESTIMATE ONES, ARE NEEDED FOR THAT (E.G. MODE AND TIME OF CONTAINMENT FAILURE): OVERALL CALCULATED DECONTAMINATION FACTORS ARE VERY SENSITIVE TO THESE ASSUMPTIONS: BATTELLE, IN ABSENCE OF OTHER GUIDANCE DATA HAS GENERALLY TAKEN THESE ASSUMPTIONS IN A CONSERVATIVE WAY: THUS RATHER LOW AND PROBABLY UNREALISTICALLY LOW OVERALL O.F. ARE BEING CALCULATED. THE WORK PERFORMED TO DATE THUS DEMONSTRATES THAT THE USE OF THE MOST UP TO DATE DATA AND CODES FOR THE CHEMICAL-PHYSICAL STUDY OF F.P. DOES NOT CONDUCT, TAKEN ALONE, TO A SOURCE TERM WHICH MAY BE CONSIDERED IN AGREEMENT WITH THE EXPERIENCE OBTAINED BY THE OBSERVATION OF REACTOR ACCIDENTS. MORE WORK IS NEEDED IS PARALLEL ON PLANT SYSTEMS BEHAVIOUR AND CONTAINMENT PERFORMANCE IN ORDER TO SUPPLY F.P. SPECIALISTS WITH A SET OF MORE REALISTIC PLANT BEHAVIOUR AND CONDITIONS ASSUMPTIONS TO BE USED AS AN INPUT FOR THEIR CALCULATIONS. IT IS MY UNDERSTANDING THAT THIS WORK HAS BEEN INITIATED IN THE

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Page I of II

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SIS

PETRANGELI

S. Sherry
7-11-72

NAME OF TWO SEPARATE NRC PROGRAMS (ACCIDENT SEQUENCES AND CONTAINMENT). IN ORDER TO CLEARLY DEFINE THE WORK PROGRAM I THINK THAT, FIRST OF ALL, IT HAS TO BE DECIDED WHAT KIND OF SEQUENCES SHOULD BE CHOSEN FOR SEVERE ACCIDENT SOURCE TERM EVALUATIONS. A POSSIBLE CHOICE COULD BE REPRESENTED BY THE RISK DOMINANT WASH-1400 SEQUENCES IN WHICH, BESIDES THE SET OF EVENTS WHICH DEFINE THE SEQUENCE ITSELF, FURTHER BEST-ESTIMATE PLANT BEHAVIOUR ASSUMPTIONS BE MADE (AS SAID BEFORE, THE SET OF EVENTS WHICH DEFINE THE SEQUENCE IS NOT A SUFFICIENT INPUT FOR F.P. CALCULATIONS). CERTAINLY, THE CHOICE OF 'ANY THINKABLE SEQUENCE' IS NOT CORRECT IN THIS CONNECTION: ONE MAY JUST THINK OF THE NONSENSE OF CONSIDERING SEQUENCES LIKE THE R ONE (CATASTROPHIC PRESSURE VESSEL RUPTURE). SEQUENCES CHOSEN FOR THE BMI 2104 WORK ARE OF A DIFFERENT KIND. THEY INCLUDE WASH 1400 RISK DOMINANT SEQUENCES WITH ADDITIONAL CONSERVATIVE PLANT BEHAVIOUR ASSUMPTIONS AND FURTHER NON RISK DOMINANT SEQUENCES SELECTED IN ORDER TO EVALUATE PLANT D.F. IN A WIDER RANGE OF CONDITIONS. IN A CERTAIN SENSE BMI 2104 SEQUENCES ARE TYPICAL TEST CASES FOR F.P. CODE RUNS MORE THAN RATIONAL REFERENCE SEQUENCES FOR SOURCE TERM EVALUATIONS. THEY SERVE THE PURPOSE OF EXPLORING CODE POTENTIAL AND RESULTS IN A WIDE RANGE OF HYPOTHETICAL TRIAL CASES. FOR THIS REASON I THINK THAT THE TITLE AND THE INTRODUCTION OF BMI 2104 SHOULD BE REVISED. AS FAR AS THE TITLE IS CONCERNED, I WOULD SUGGEST TO DROP THE 'LWR SPECIFIC SEQUENCES' WORDING AND TO REPLACE IT WITH SOMETHING LIKE 'LWR HYPOTHETICAL CODE TEST SEQUENCES' IN THE INTRODUCTION. IT SHOULD BE CLEARLY STATED THAT THIS WORK IS ONLY THE FIRST PART OF A MULTIDISCIPLINAR AND ITERATIVE WORK FOR SOURCE TERM REASSESSMENT. NO HINT SHOULD TRANSPIRE THAT BMI 2104 MAY BE USED, PER SE, TO SUPPLY WORKING SOURCE TERM DATA FOR EITHER REFERENCE ENVIRONMENTAL CONSEQUENCES OR FOR EQUIPMENT QUALIFICATION EVALUATIONS. FOR THE LAST, IN PARTICULAR, BMI 2104 RESULTS MAY BE SIGNIFICANTLY UNCONSERVATIVE. FOR THE PARALLEL WORK ON PLANT BEHAVIOUR, THE FOLLOWING POINTS SEEM TO ME OF SPECIAL SIGNIFICANCE: - COMPLETE COVERAGE OF ALL THE AVAILABLE PLANT SYSTEMS AND PHENOMENA (E.G. STAND BY LIQUID CONTROL SYSTEM, CONTROL ROD DRIVE COOLING SYSTEM, CONTAINMENT VENT LINES FOR BWRs AND PUMP SEAL BEHAVIOUR IN ACCIDENTS FOR PWRs, WATER LOCATION AND CONDITIONS IN THE PLANT FOR BOTH). - CONTAINMENT ELECTRICAL PENETRATIONS AND PASSAGE GASKETS SHOULD CAREFULLY BE CONSIDERED IN THE CONTAINMENT FAILURE MODE AND TIMING EVALUATIONS. RELEVANT PHENOMENA MIGHT BE: ORGANIC MATERIAL DEGRADATION DUE TO COMBINED PRESSURE, TEMPERATURE AND RADIATION EFFECTS CONDUCTING TO THE OPENING OF LEAK PATHS; AEROSOL DEPOSITION IN LEAK PATHS WITH TWO POSSIBLE CONSEQUENCES: PATH PLUGGING OR FURTHER PENETRATION DAMAGE DUE TO DECAY HEAT OF DEPOSITED AEROSOLS (BATTELLE EVALUATED 400°F TEMPERATURE INCREASE OF STRUCTURES WHERE AEROSOLS WERE DEPOSITED). - EVALUATION OF CONTAINMENT SUBCOMPARTMENTS THERMAL HYDRAULIC CONDITIONS. - CONSIDERATION OF HUMAN FACTORS NOT ONLY AS A SOURCE OF ERROR BUT ALSO AS CONDUCTIVE TO RECOVERY AND REPAIR ACTIONS DURING ACCIDENTS (SEE E.G. WASH 1400 APPENDIX XI PAGE 3-50 AND FOLLOWING, BROWNSFERRY FIRE).

HANKYOU AGAIN AND BEST REGARDS.

G. PETRANGELI ENEA DISP ROMA