

**Department of Energy**

Washington, DC 20585

MAR 28 1995

The Honorable John T. Conway  
Chairman  
Defense Nuclear Facilities Safety Board  
Suite 700  
625 Indiana Avenue, N.W.  
Washington, D.C. 20004

Dear Mr. Conway:

On July 18, 1994, the Assistant Secretary for Defense Programs committed to providing you an analysis concerning the aircraft crash frequency data used in the Zone 4 Final Safety Analysis Report (FSAR), any identified impact to the authorization basis, and any required changes to the FSAR once the review had been completed.

In response to those commitments, enclosed is a copy of the Unreviewed Safety Question Determination on the Zone 4 Aircraft Crash Analysis, along with a justification for continued operations and the approval by the Manager, Albuquerque Operations Office.

Should you have any questions on the reports provided, please contact me or have your staff contact Michael Mitchell of my staff at (301) 903-3085.

Sincerely,

A handwritten signature in black ink that reads "Charles J. Beers, Jr." with a stylized flourish at the end.

Charles J. Beers, Jr.  
Rear Admiral, U.S. Navy  
Deputy Assistant Secretary for  
Military Application and  
Stockpile Support  
Defense Programs

Enclosures

cc w/o enclosures:  
M. Whitaker, EH-9

United States Government

Department of Energy

# memorandum

Albuquerque Operations Office

DATE: MAR 10 1995

REPLY TO  
ATTN OF: NSD

SUBJECT: Approval of Positive Unreviewed Safety Questions

TO: G. W. Johnson, Area Manager, AAO

Three positive Unreviewed Safety Questions (USQs) have been submitted for review and approval:

1. Building 12-44 Blast Door Interlock (BDI) System,
2. Zone 4 Aircraft Crash, and
3. Building 12-84, Bay 14 Fire Suppression System.

DOE Order 5480.21, paragraph 9 and 10, requires Program Secretarial Officers to approve situations determined to involve a USQ. The attached memorandum delegates approval authority of the subject USQs to my office.

Justification for Continued Operations (JCOs) have been developed for both the BDI System USQ and the Zone 4 Aircraft Crash USQ. The Building 12-84, Bay 14 Fire Suppression System USQ identifies that the bay is in a maintenance mode, i.e., there are no operations taking place currently; therefore, a JCO has not been developed.


The USQ Determinations (USQDs) and associated JCOs have demonstrated that by instituting administrative controls, the DOE approved safety envelope is maintained and continuing operations is acceptable for Zone 4 and Building 12-44, Cells 2-6 respectively. Operations will not be conducted in Building 12-84, Bay 14, until appropriate modifications to the fire suppression for that facility have been made.

Therefore, approval is granted to continue operations within Zone 4 and Building 12-44, Cells 2-6 respectively and to implement the proposed redesign of the fire suppression system for Building 12-84, Bay 14. Also, revisions required to current authorization basis documents, Critical Safety System Manual, to reflect the implementation of



MAR 10 1995

administrative controls and/or corrective actions should be completed. If there are any questions, please call Liz Roybal of the Nuclear Safety Division at (505) 845-5684.

  
for  
Bruce G. Twining  
Manager

**Attachment**

**cc w/attachment:**

C. Irvin, EH-53, HQ  
S. Young, M&H, Pantex  
Plant  
D. Bergman, OMD, AL  
R. Steen, TSD, AL

**cc w/o attachment:**

RADM C. Beers, Jr., DP-20,  
HQ  
M. Mitchell, DP-24, HQ  
T. Dobry, DP-24, HQ

United States Government

Department of Energy

# memorandum

DATE: February 17, 1995

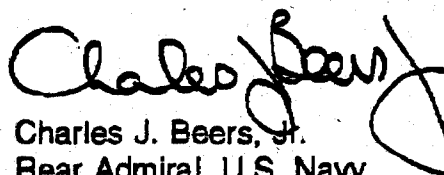
REPLY TO  
ATTN OF: DP-24:Stair:3-7768SUBJECT: RESOLUTION OF ISSUES REGARDING DELEGATION OF APPROVAL  
AUTHORITY FOR POSITIVE UNREVIEWED SAFETY QUESTION  
TO: DETERMINATIONS

Manager, Albuquerque Operations Office

My staff has informed me of the status of three current positive Unreviewed Safety Question Determinations (USQD) at Pantex. These involve the Blast Door Interlock System, the Fire Suppression Heat Shield, and the Aircraft Crash Analysis.

It is my understanding that you have requested approval authority for these three positive USQDs. Based upon this request and the information provided by my staff, I am delegating to you the approval authority for the three aforementioned positive USQDs.

If you have any questions concerning this matter, please contact me or have your staff contact Mike Mitchell at (301) 903-3085.



Charles J. Beers, Jr.  
Rear Admiral, U.S. Navy  
Deputy Assistant Secretary for  
Military Application and  
Stockpile Support  
Defense Programs



# memorandum

 Albuquerque Operations Office  
 Amarillo Area Office

DATE: JAN 06 1995

REPLY TO  
ATTN OF: AAO:SHS:CMS

SUBJECT: Positive Unreviewed Safety Question Determination (USQD) on the Zone 4 Aircraft Crash

TO: B. G. Twining, Manager, AL

On January 6, 1995, Mason & Hanger formally delivered to the Amarillo Area Office (AAO) a Safety Evaluation (Unreviewed Safety Question Determination (USQD) PX-USQD-94-45) entitled Zone 4 Aircraft Crash - New Information (Attachment 1). This evaluation was requested by the Amarillo Area Office (AAO) in accordance with DOE Order 5480.21. The analysis indicates that the annual probability of aircraft crashes, presented in Table F-11 (Appendix F) of the Zone 4 Final Safety Analysis Report (FSAR), is in error. Using the best currently available methods, the correct probability is a multiplicative factor of 10.7 larger than the value calculated in the Zone 4 FSAR. The major reason for this analytic error was a faulty methodology for measuring the orthonormal distances from the ground track of the various airways to the geometric center of Zone 4. The following table summarizes the results.

Summary of 1992 FSAR crash probabilities and best available results of the new analysis		
Aircraft Type * (T <sub>i</sub> )	Zone 4 FSAR Table F-11 annual probabilities	New analysis annual probabilities (P <sub>i</sub> ) using best available methods
T <sub>1</sub> (Air Carrier)	2.78X10 <sup>-8</sup>	3.32X10 <sup>-7</sup>
T <sub>2</sub> (Military Application)	2.50X10 <sup>-7</sup>	9.35X10 <sup>-7</sup>
T <sub>3</sub> (General Aviation)	1.52X10 <sup>-6</sup>	1.84X10 <sup>-5</sup>
T <sub>4</sub> (Aerial Application)	5.42X10 <sup>-8</sup>	7.29X10 <sup>-8</sup>
TOTALS	1.85X10 <sup>-6</sup>	1.98X10 <sup>-5</sup>

\* This is the generic stratification of aircraft into the listed subcategories used in the Zone 4 FSAR.

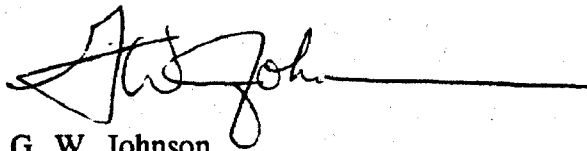
As can be seen from the above table, the change in the General Aviation category probabilities caused (to first order) the change in the overall crash probabilities. The other categories (Air Carrier, Military aviation, Aerial Application) remain formally incredible scenarios.

In accordance with DOE Order 5480.21, the increase in the probability of occurrence of a malfunction of equipment [Zone 4 Magazine structure] important to safety constitutes a positive USQD.

Completion of a Justification for Continued Operations (JCO) was requested by AAO in parallel with the USQD (Attachment 2). The purpose of the JCO was to determine the risk verses benefit of continued plant operations. The technical definition of risk is the probability of an occurrence times the consequence of the occurrence. In accordance with the data presented in this memorandum, the probability of the aircraft crash into a Zone 4 magazine has increased. However, stress analysis of the Zone 4 magazines indicates that a 5000 lb aircraft with an impact speed of 80 mph or a 3500 lb aircraft with a speed of 110 mph is incapable of causing structural failure. Because the range of weights [0, 5000 lbs] is representative of most of the single-engine aircraft in the General Aviation category, and most of the aircraft cannot penetrate a magazine, AAO concurs with the Mason & Hanger JCO conclusion that the benefit to the Nation of continued operation out weighs the marginal increase in risk. Therefore, AAO concurs with the JCO effective January 6, 1995.

An aggressive and proactive strategic plan for completing actions that will reduce the probability from the currently calculated crash probability back to the formally incredible point ( $1 \times 10^{-6}$ /year) is under way. This plan has already resulted in an agreement between DOE and the Federal Aviation Administration (FAA) to reduce the number of aircraft flying over the plant through amendment of air traffic controller flight control procedures. A second agreement was signed on January 3, 1995, between DOE and the FAA to install a Radar Airspace Monitoring System (RAMS) so that more accurate flight data can be collected. This data will be used to perform an accurate state-of-the-art analysis of the crash probabilities before December 31, 1995. Approximately \$1,400,000 of FY 1995 funding has been allocated FY 95 to move airport navigational hardware at the Amarillo Airport to further reduce the crash probabilities.

The Albuquerque Operations Office is the approval authority for Unreviewed Safety Questions. AAO requests that Safety Programs Division review and approve the USQD.



G. W. Johnson  
Area Manager

2 Attachments:

cc w/attachments:  
(See page 2)

V. Reis, ASDP HQ  
RADM Beers, DASMA HQ  
D. Rhodes, DP-24 HQ  
M. Mitchell, DP-24 HQ  
J. Stan, DP-24 HQ  
J. Stair, DP-24 HQ  
T. Dobrey, DP-24 HQ  
N. Dienes, DOE, AL  
D. Rigdon, DOE, AL  
D. Brunell, DOE, AAO  
W. Weinrich, M&H, AAO  
H. Berman, M&H, AAO  
S. Young, M&H  
R. Hedke, M&H

## PANTEX SAFETY EVALUATION COVER SHEET



Date: January 6, 1995

Safety Evaluation ID Number: PX-USQD-94-45Safety Evaluation Title: Zone 4 Aircraft Crash - New InformationUSQ Evaluator: Alan ScruggsBuilding Identification: Zone 4 West Material Access AreaFacility/Building Manager: Steve UffordPhone: 4030**Summary Description:**

The Defence Nuclear Facilities Safety Board (DNFSB) questioned the aircraft crash analysis contained in the approved Zone 4 Final Safety Analysis Report (FSAR). Specifically, the DNFSB questioned the calculations of the probability of an aircraft crash into a Zone 4 magazine. The DNFSB requested the Department of Energy to prepare a safety evaluation examining the impact of using flight data taken in 1989 in conjunction with other errors noticed in the FSAR.

**Summary Conclusion:**

This safety evaluation has determined that a USQ does exist for Zone 4. The pedigree of the 1989 data was questionable; therefore, the results using this data were not considered in the evaluation. However, several other errors were documented in the FSAR's analysis and when corrected, resulted in an increase in the probability of an aircraft crash into a magazine (capable of penetrating the magazine and releasing radioactive contamination) of a factor of 10.7. This increase was considered sufficient to warrant the declaration of a positive unreviewed safety question for this situation.

Based on the safety evaluation attached hereto, the subject issue:

Involves a USQ?	Yes
Requires an OSR/TSR change?	No
Requires a FSAR change?	Yes
Requires DOE approval?	Yes



No. PX-USQD-94-45

1.0 Title: Zone 4 Aircraft Crash - New Information

2.0 Building(s) Affected: Zone 4 MAA

3.0 Describe the subject issue:

*Subject Issue:*

Does the new information referenced in the Defence Nuclear Facility Safety Board's (DNFSBs) letter dated 28 June, 1994, increase the probability of an aircraft crash into a Zone 4 West magazine to the point it becomes an Unreviewed Safety Question (USQ)?

*Background:*

The approved Final Safety Analysis Report (FSAR) for Zone 4 (Issue E)<sup>a</sup> includes a calculation of the probability of an aircraft crashing into one of the staging magazines in the Zone 4 West Material Access Area (MAA). The air traffic volume information used for the calculation was contained in a study performed by Sandia National Laboratories (Sandia) in 1976.

Since that time, additional air traffic data was gathered in 1989. Flight data was collected during 1989 and was obtained from Sandia during a May 1994 meeting in Albuquerque between the DOE and the DNFSB. The 1989 flight information was obtained over two, one week periods, during January and April of 1989.

On June 28, 1994, the DNFSB requested the Department of Energy (DOE) to perform a safety evaluation using the new information to determine if a USQ existed. In addition to the new flight information available, the DNFSB also found some minor errors in the methodology used to compute aircraft probabilities in the Zone 4 FSAR. On July 15th, in a letter to the Mason & Hanger-Silas Mason Co., Inc. (M&H) General Manager, the DOE subsequently requested M&H to prepare a safety evaluation<sup>b</sup>.

According to Mr. Randy Burns, the acting Federal Aviation Administration (FAA) manager for Amarillo, calculations using only two weeks worth of data would be invalid since the volume of air traffic to and from the Amarillo International Airport varies a great deal. He stated that a longer sampling time would be necessary to get an accurate data set. The Sandia point of contact, Mr. Y.T. Lin, indicated that the methods for obtaining the data and converting it to the form presented cannot be verified. Considering the above statements, this data is suspect. Nevertheless, the 1989 data has been reviewed and new crash probabilities computed<sup>c</sup>. In accordance with plant standards<sup>d</sup> this safety evaluation will compare the newly calculated probability results to the approved FSAR for Zone 4.

No. PX-USQD-94-45

- 4.0 Complete the checklist below. Directly below each item checked "YES," briefly explain the relationship between the items below and the subject issue. To determine or describe how the subject issue would effect questions 6.0 through 19.0, consider the following concerns:

**RADIOACTIVE/HAZARDOUS MATERIALS**

- 4.1 Radioactive/hazardous material containment or confinement integrity Yes X No

In the event of a large aircraft crashing into a magazine, the potential exists for a breach of containment and or hazardous materials to be spread in the immediate area. However, for the purposes of this USQD, only the hit probabilities are being evaluated.

- 4.2 Potential for personnel exposure to radioactive/hazardous materials Yes X No

The potential for personnel exposure to radioactive materials is related to the probability of a crash.

- 4.3 Radioactive/hazardous/mixed waste Yes      No X

- 4.4 Handling of radioactive/hazardous materials Yes      No X

- 4.5 Storage of radioactive/hazardous material Yes X No

Radioactive materials are staged in the Zone 4 magazines.

- 4.6 Layout/configuration of radioactive/hazardous materials Yes X No

The configuration of the Zone 4 magazines affects the effective area calculations used in the aircraft crash probability analysis.

- 4.7 Quantity of radioactive/hazardous materials Yes      No X

- 4.8 Nuclear Criticality Yes      No X

- 4.9 Single failure criteria or double contingency principle Yes      No X

No. PX-USQD-94-45

**NATURAL PHENOMENA**

- 4.10 Facility/equipment seismic analysis Yes \_\_\_ No X  
4.11 Exposure to extreme winds/tornado Yes \_\_\_ No X  
4.12 Consequences of exterior flooding/rainwater Yes \_\_\_ No X  
4.13 Consequences of lightning Yes \_\_\_ No X

**FIRE PROTECTION**

- 4.14 Fire loads Yes \_\_\_ No X  
4.15 Fire suppression system Yes \_\_\_ No X  
4.16 Probability/impact of internal building flooding Yes \_\_\_ No X  
4.17 Fire alarm system Yes \_\_\_ No X

**EXPLOSIVES**

- 4.18 Movement of explosives Yes \_\_\_ No X  
4.19 Storage of explosives Yes \_\_\_ No X  
4.20 Layout/configuration of explosives Yes \_\_\_ No X  
4.21 Explosive limits/TNT equivalents Yes \_\_\_ No X  
4.22 Explosive initiators Yes \_\_\_ No X

**INDUSTRIAL HYGIENE**

- 4.23 Room/building habitability Yes \_\_\_ No X  
4.24 Asbestos Yes \_\_\_ No X  
4.25 Chemical exposure Yes \_\_\_ No X

No. PX-USQD-94-45

**PROCEDURES**

- 4.26 Potential consequences of procedure errors Yes \_\_\_ No X
- 4.27 Emergency procedures change/addition/deletion Yes \_\_\_ No X
- 4.28 Increase in frequency of existing operations Yes X No \_\_\_

The 1989 flight data was used to determine if the frequency of aircraft overflights has changed since the 1976 study was performed.

**SAFETY ANALYSIS**

- 4.29 Design basis assumptions, or values used in FSAR Yes X No \_\_\_

The values and calculations in appendix F of the Zone 4 FSAR are being questioned by the DNFSB. This safety evaluation will examine the impacts of the new data on the currently approved FSAR.

- 4.30 Operational Safety Requirements/Technical Safety Requirements/TSSOPs Yes \_\_\_ No X

**STRUCTURAL CONSIDERATIONS**

- 4.31 Blast missile protection Yes \_\_\_ No X
- 4.32 New penetrations Yes \_\_\_ No X
- 4.33 Crane/hoist loads Yes \_\_\_ No X
- 4.34 New structure Yes \_\_\_ No X

**MECHANICAL CONSIDERATIONS**

- 4.35 Mechanical failure Yes \_\_\_ No X

No. PX-USQD-94-45

- |      |                                   |         |             |
|------|-----------------------------------|---------|-------------|
| 4.36 | System/component performance      | Yes ___ | No <u>X</u> |
| 4.37 | Materials compatibility/corrosion | Yes ___ | No <u>X</u> |
| 4.38 | Equipment operating temperatures  | Yes ___ | No <u>X</u> |
| 4.39 | Control signal failure            | Yes ___ | No <u>X</u> |
| 4.40 | Control setpoint change           | Yes ___ | No <u>X</u> |
| 4.41 | Building/room pressurization      | Yes ___ | No <u>X</u> |
| 4.42 | Heat transfer/thermal loads       | Yes ___ | No <u>X</u> |

**ELECTRICAL CONSIDERATIONS**

- |      |                                |         |             |
|------|--------------------------------|---------|-------------|
| 4.43 | Electrical failure             | Yes ___ | No <u>X</u> |
| 4.44 | Diesel generator loading       | Yes ___ | No <u>X</u> |
| 4.45 | Battery/electrical bus loading | Yes ___ | No <u>X</u> |
| 4.46 | Control signal failure         | Yes ___ | No <u>X</u> |

**EQUIPMENT**

- |      |                                   |         |             |
|------|-----------------------------------|---------|-------------|
| 4.47 | Equipment installation/relocation | Yes ___ | No <u>X</u> |
| 4.48 | Equipment/component replacement   | Yes ___ | No <u>X</u> |
| 4.49 | Lockout/tagout violation          | Yes ___ | No <u>X</u> |

**MISCELLANEOUS**

- |      |   |         |             |
|------|---|---------|-------------|
| 4.50 | Other Concerns<br>(Not listed above, but which should be considered.) | Yes ___ | No <u>X</u> |
|------|---|---------|-------------|

No. PX-USQD-94-45

**5.0 List all reference documents consulted for this safety evaluation (DOE Orders, FSARs, manuals, reports, procedures, design criteria, drawings, schematics, etc.):**

- a) "Pantex Plant Final Safety Analysis Report Zone 4 Magazines," Issue E, September 1993.
- b) Letter, Donald Brunell to W. A. Weinreich, July 15, 1994.
- c) *Review of Aircraft Crash Probability Calculations in the Zone 4 Safety Analysis Report*, Rev. 1, December 15, 1994.
- d) Plant Standard STD-3014, "Unreviewed Safety Question Determination," Issue 3, December 23, 1994.
- e) "Safety Evaluation Report," DP SER 92-1, December 1992.

**6.0 List the parameters and systems directly or indirectly affected by the subject issue:**

The subject issue involves errors in the calculations to determine the probability of an aircraft crash into a Zone 4 magazine. Since the consequences of the crash are not being examined, parameters and systems associated with consequence calculations are not affected.

Parameters which affect the probability calculations include:

- Magazine dimensions (length, width, & height)
- Aircraft wingspan
- Aircraft flight data from 1989 (number of flights, types of aircraft, location of flight path, etc.)
- "Orthonormal" distance (the minimum perpendicular distance from the geometric center of Zone 4 West to the ground track of a particular airway).

**7.0 List any safety-related or important-to-safety structures, systems, or components (SSCs) identified in question 6.0 above:**

Refer to the response to question 6.0 above. There are no magazine SSCs affected by the probability calculations.

**8.0 Identify the operating functions for the SSCs listed in question 7.0 under normal, abnormal, and emergency conditions:**

There are no magazine SSCs associated or affected by the subject issue.

No. PX-USQD-94-45

**9.0 Identify applicable operating conditions (SLs, LCSs, LCOs, AC, SR, etc.) of equipment discussed in question 7.0 above:**

There are no approved Technical Safety Requirements (TSRs) associated with the probability of an aircraft crash into a Zone 4 magazine.

**10.0 Identify the credible failure modes associated with the subject issue:**

The subject issue involves the probability of an aircraft crash. The failure modes for aircraft are numerous, and are not detailed in this safety evaluation.

**11.0 Identify the hazards and accidents discussed in the authorization basis (i.e., FSAR, FMEA, DBA, etc.) for which failure modes associated with the subject issue can be an initiating event:**

The only accident discussed in the Zone 4 FSAR initiated by an aircraft failure is the crash of an aircraft into one or more of the Zone 4 magazines, resulting in a release of radionuclides. An aircraft crash is discussed in Appendix F of the FSAR.

**12.0 Discuss the impact of the subject issue on the probability of occurrence of the accidents:**

Recent analysis<sup>c</sup> provides a new probability of an aircraft crash into Zone 4 of  $1.98 \times 10^{-5}$ . This does not take into consideration the seventy-seven percent reduction for general aviation flights below 18,000 feet, but this does correct the errors discovered in the FSAR analysis using the 1976 flight data. The probability using the 1989 data is contained in the analysis, but was not considered since it was deemed not a reliable indicator of the actual number of aircraft overflights.

The new probability represents an increase over the Zone 4 FSAR probability of  $1.85 \times 10^{-6}$  by a factor of 10.7. This increase is in a "nonconservative" direction and taking a conservative point of view is judged to represent an increase in the probability of an aircraft crash.

**Could the subject issue increase the probability of any accident identified in question 11.0 above?**

Yes X No

No. PX-USQD-94-45

- 13.0 Discuss how the parameters and systems identified in question 6.0 impact the consequences of the DBAs:

The consequences of the DBA were not affected by the new information, only the probability. The design basis accident has not changed, it evaluates an aircraft crash by a large military aircraft.

Could the subject issue increase the consequences of an accident previously evaluated in a Safety Analysis?

Yes \_\_\_ No X

- 14.0 Discuss the impact of the subject issue or the failure modes associated with the subject issue on the probability of failure of the systems identified in question 7.0:

The subject issue does not concern itself directly with the failure of any magazine SSCs. However, it can be argued that the probability of a failure of the magazine structure would increase if the probability of a crash increased. This "virtual" probability is considered to be beyond consideration for this evaluation.

Could the subject issue increase the probability of malfunction of equipment important to safety previously evaluated in a Safety Analysis?

Yes \_\_\_ No X

- 15.0 Discuss the impact of the subject issue on the performance of the safety systems identified in question 7.0:

The probability of an aircraft crash does not alter the performance of any safety SSC.

Could the subject issue increase the consequences of a malfunction of equipment important to safety previously evaluated in a Safety Analysis?

Yes \_\_\_ No X

- 16.0 Could the subject issue create the possibility of a different type of accident than any evaluated in previous Safety Analyses?

Yes \_\_\_ No X

Explain:

The only type of accident involved with the subject issue is the aircraft crash. This accident was previously analyzed in the approved FSAR for Zone 4. Therefore, a new or different type of accident is not involved.



No. PX-USQD-94-45

- 17.0 Discuss whether or not the failure modes of equipment important-to-safety associated with the subject issue represent a new unanalyzed type of malfunction:

The failure modes of the aircraft were not examined. Since the SSCs for the Zone 4 magazines are unchanged by the probability of an aircraft crash, they do not represent an unanalyzed type of malfunction.

Could the subject issue create the possibility of a different type of malfunction of equipment important to safety than any evaluated in previous Safety Analyses?

Yes \_\_\_ No X

- 18.0 Does the subject issue reduce the Margin of Safety as defined in the basis for any Technical Safety Requirement?

Yes \_\_\_ No X

Explain:

The margin of safety concerning the release of radiological materials associated with aircraft overflights involves the resistance of the magazines/containers to penetration by the aircraft. The construction of the magazines is unaffected by the subject issue; therefore, the subject issue does not change the margin of safety.

- 19.0 Does the subject issue require a change to an OSR, TSR, nuclear criticality safety limit or their basis? (NOTE: Changes involving typographical errors, etc., may be made without DOE approval.):

Yes \_\_\_ No X

Explain:

The Technical Safety Requirements for Zone 4 are not affected by the probability of an aircraft crash.

- 20.0 Are there any Occurrence or Nonconformance Reports pending which concern the subject issue?

Yes \_\_\_ No X

List and evaluate impact:

None involve aircraft of any type.

No. PX-USQD-94-45

NOTE:

IF THE ANSWER TO ANY OF QUESTIONS 12.0 - 18.0 IS "YES", AN UNREVIEWED SAFETY QUESTION (USQ) EXISTS, AND DOE APPROVAL IS NECESSARY PRIOR TO THE IMPLEMENTATION OR CONTINUATION OF THE SUBJECT ISSUE. IF THE ANSWER TO QUESTION 19.0 IS "YES", DOE APPROVAL FOR THE SUBJECT ISSUE IS REQUIRED PRIOR TO ITS IMPLEMENTATION. REFER TO STD-3014 FOR INSTRUCTIONS.

21.0 Summary conclusion:

NOTES:	USQ?	<u>Yes</u>
	OSR/TSR Basis Change?	<u>No</u>
	FSAR Content Change?	<u>Yes</u>
	DOE Approval Required?	<u>Yes</u>

Correcting the errors in the FSAR analysis and using the new flight data from 1989 does not represent a USQ. However, correcting the errors and using the 1976 flight data does result in a discernable increase in the crash probability and thus a USQ. While the overall probability of the aircraft crash does increase with the new data, the credibility of the data itself is suspect, and an unreviewed safety question determination based on the 1989 data will not be made for this reason. However, errors in the Zone 4 FSAR were found and corrected which did affect the probability as presented in the FSAR. These errors were:

- The total wingspans of the aircraft were reduced to 1/3 of their actual lengths prior to the calculations for the "effective area"
- The variables "a" and "b" (structure length and width, respectively) were reversed in the calculations for the "true area"
- The values for the length of the wingspans prior to the 2/3 reduction were incorrect
- The "orthonormal" distances from the ground track of the various airways to the geometric center of Zone 4 were incorrect

Of the four errors noted above, only the last one dealing with the "orthonormal" distances had any real effect on the probability of an aircraft crash into Zone 4. The effect of correcting the errors was a factor of 10.7 increase in the probability of an aircraft crash from what was approved in the FSAR. This is an increase in a nonconservative direction, and represents an **UNREVIEWED SAFETY QUESTION**.

No. PX-USQD-94-45

Although a USQ has been identified, several factors should be taken into consideration. The current probability of an aircraft crash into Zone 4 is unknown, but might be lower than the values calculated in the FSAR<sup>a</sup> or recent analysis<sup>c</sup>. This statement is based on the assumption that the values used in the FSAR were too conservative. An independent review of the operations in Zone 4 was performed by the Technical Safety Review Panel chartered by DOE Headquarters. Their results for aircraft crash were an order of magnitude lower than those in the FSAR<sup>c</sup>. In addition, several short and long term initiatives are planned which will have a positive affect on decreasing the risk due to aircraft operations near Pantex Plant:

Short term initiatives:

- Memorandum of Understanding (MOU) between DOE and Federal Aviation Administration (FAA).
- Develop and install Offset Localizer Approach with Glide Slope to runway 22.

The MOU provides an immediate reduction in risk in that the local air traffic controllers will realign discretionary holding pattern procedures and optimize radar vectoring for approaching aircraft to minimize time over the plant. The installation of the localizer approach will move the primary approach course approximately one mile west of Zone 4. This initiative requires DOE funding and is contained within the "Interagency Agreement" described below.

Long term initiatives:

- Moving the VORTAC to the Amarillo International Airport.
- Develop and implement a Global Positioning System (GPS) Precision Approach to runway 22.

Both of these initiatives effectively move the enroute air traffic further west and south of the plant. These actions increase the "orthonormal" distance from the airways to the plant, reducing the "relative" probability of an aircraft crash by up to 50%. The DOE is close to signing an "Interagency Agreement" with the FAA which will provide the funds for moving the VORTAC and installing the Offset Localizer Approach. Furthermore, the DOE is actively pursuing steps to determine the current risk to operations from aircraft overflights. The first involves the installation by Sandia National Laboratories of a Radar Airway Monitoring System (RAMS) which will survey the airspace around Pantex and document all aircraft operating within the region to provide the best possible flight information. Secondly, the DOE, in conjunction with the Nuclear Regulatory Commission and the FAA, will publish a new standard for computing aircraft crash probabilities in 1995. This standard will improve on the "Solomon" model currently used. When available, this information will enable Pantex to more accurately estimate the probability of an aircraft crash into Zone 4.

No. PX-USQD-94-45

The new probabilities will be incorporated into the Programmatic Environmental Impact Statement (PEIS) being prepared for the Pantex Plant, and the update to the Zone 4 FSAR, currently planned for December of 1995.

Finally, DOE Defense Programs (DP-24) is involved in the preparation of analyses looking at the impacts of postulated aircraft crash events. The structural analyses should be completed in 1995 and will increase our understanding of the consequences of aircraft accidents.

Prepared by:

Reviewed by:

Alan Scruggs 1/5/95  
USQ Evaluator Date

David [Signature] 1/5/95  
USQ Evaluator Date

Approved by:

[Signature] 1/5/95  
Division Manager, E&D Date

## JUSTIFICATION FOR CONTINUED OPERATION OF ZONE 4 OPERATIONS WITH AN INCREASED PROBABILITY FOR AIRCRAFT CRASH

### 1.0 PURPOSE

The purpose of this Justification for Continued Operation (JCO) is to provide the basis for continued staging operations in Zone 4 in light of the positive unreviewed safety question determination (USQD) concerning the inadequate aircraft crash analysis contained in the Final Safety Analysis Report (FSAR). The FSAR provided the sole authorization basis for Zone 4 until the recent completion, and DOE approval, of the Basis for Interim Operations (BIO). This JCO, upon approval, will add to the authorization basis for Zone 4 operations and supplement the BIO and the FSAR until the aircraft crash analysis is updated or a new analysis is completed as part of the DOE's Site-Wide Environmental Impact Statement (SWEIS). The current FSAR for Zone 4 lists the annual probability of an aircraft crash, of any type, into a magazine as approximately  $1.9E-06$ . The results of the USQD supporting analysis indicate the probability, using the same data and methodology, is about an order of magnitude higher.

The rationale for using a JCO is described in the DOE/Headquarters memorandum of December 29, 1992, which provides the interpretation for DOE Order 5480.21, "Unreviewed Safety Questions." The memorandum describes the use of the JCO for situations in which the contractor requires continued operations which could be outside the authorization basis. In this situation, the reason for the JCO stems from an "inadequate" safety analysis, thus the positive USQD. The "inadequate" safety analysis resulted partly from errors in the FSAR, and the map resources used to measure distances in the original 1976 study were not detailed, but the model used was, and is, only an "order-of-magnitude" model. The JCO will not replace the FSAR analysis. Rather, this JCO will cite compelling reasons to continue operations and enumerate the planned and ongoing positive measures to reduce the number of flights over Pantex Plant.

Although not specifically mentioned by letter in the body of this JCO, the references given in Section 8.0 are included as pertinent background information upon which the results of this JCO are based.

### 2.0 BACKGROUND/STATEMENT OF THE PROBLEM:

Zone 4 magazines are used as staging, or interim storage facilities for nuclear explosives and major components. Five types of items may be housed in these magazines: (1) nuclear explosive assemblies, (2) pits, (3) radioisotopic thermoelectric generators (RTGs), (4) Oak Ridge Operation (ORO) components, and (5) nuclear explosive-like assemblies (NELAs). There are 18 modified-Richmond magazines and 42 steel arch construction (SAC) magazines in the western portion of Zone 4. Under the current Environmental Assessment for Zone 4, up to 12,000 pits may be staged, on an interim basis, pending the results of the site wide environmental impact statement (SWEIS).

Magazines remain secured in Zone 4 unless being accessed. No more than five concrete barriers can be removed at any one time. Only four magazines may be opened on any row at one time and must be under the observation of an armored vehicle. Movement of special nuclear materials into or out of Zone 4 magazines is controlled by the nuclear material control room. Measures are taken to tightly control nuclear material and the doors to the magazines.

The Zone 4 Final Safety Analysis Report (FSAR) contains an analysis of the probability for an aircraft crashing inside the zone. The data used for the analysis was taken from a Sandia National Laboratory report published in 1976. The same data and methodology were used for the Zone 4 FSAR analysis. Appendix F of the FSAR provides the details of how the analysis was accomplished. Critics of the Zone 4 FSAR have maintained that errors were made in the analysis as described in Appendix F. The Environmental Assessment (EA) was completed for Zone 4 (January 1994) and a Finding of No Significant Impact (FONSI) determined by the Department of Energy. Since the EA aircraft analysis also used the same data and methodology as the FSAR, the same critics continued their objections. The meeting which precipitated the unreviewed safety question determination (USQD) took place May 9-11, 1994, at the DOE Operations Office in Albuquerque, NM, and involved members of the Defense Nuclear Facilities Safety Board (DNFSB) and the DOE. Issues were not satisfactorily resolved at that meeting which resulted in the DNFSB letter, dated June 28, 1994, to the Assistant Secretary for Defense Programs (ASDP), requesting that the USQ process be used to resolve the remaining aircraft crash analysis issues. A review of the 1976 data and the FSAR analysis was undertaken. Several errors were discovered in the analytical process. A USQD was initiated to determine if the new information referenced in the DNFSB's June 1994 letter would result in a "clear and discernible increase" in the probability of an aircraft crash into Zone 4.

The primary authorization basis documents for Zone 4 are the "Basis for Interim Operation," October 20, 1994; the Pantex Plant Final Safety Analysis Report Zone 4 Magazines," Issue E, September 1993; and MNL 1101 Addendum 1B, Listing of Critical Safety Systems (CSSM), August 26, 1994. The following are references from the currently approved Final Safety Analysis Report (FSAR) which relate to the "inadequate" safety analysis.

Chapter 2.0 (Summary/Conclusion), page 2-6, section 2.1.3 (first bullet): "Aircraft Crash - An analysis of the conditional probabilities and consequences of an aircraft crash into a magazine showed that those aircraft crashes sufficient to cause damage and potential release of radioactive material were found to be incredible. Crashes that could credibly occur have negligible consequences."

Chapter 7.0 (Accident Analysis), page 7-11, section 7.2.1. Aircraft Impacts (1st paragraph): "The analysis indicates that the likelihood of any class of aircraft impacting into any of the 60 Zone 4 Material Access Area (MAA) magazines is approximately 1.9E-06 per year. Because the overall estimated probability of impact is greater than 1.0E-06 per year, the event would be considered credible."

Chapter 7.0 (Accident Analysis), page 7-12, section 7.2.1. Aircraft Impacts (2nd paragraph): "When the probability calculation was redone to reflect only aircraft crashes capable of damaging a Zone 4 magazine structure, the overall estimate of the probability of aircraft crash dropped below the 1.0E-06 per year threshold."

Appendix F (Aircraft Hazard Analysis), page F-13, section F.2.1 Estimation of the Impact Area (3rd paragraph): "In this analysis, the wingspans were modified to include essentially only the inboard one-third of the span. This was based primarily on two considerations: (1) the magazines are very compact structures, well shielded with earth; therefore, it will require more than a grazing hit by a wing tip to cause damage, and (2) the arrangement of the magazines in Zone 4 West is such that if just the tip of a large wing were to impact one magazine, major portions of the aircraft could be impacting another."

Appendix F (Aircraft Hazard Analysis), page F-21, section F.2.2 Example Area Calculation SAC Magazine Group of Three (True Area Calculation): The values for the true areas have the smaller dimension outside the parentheses (13 versus 24).

Appendix F (Aircraft Hazard Analysis), page F-28, Table F-12 Yearly Operations (77% General Aviation Below 18,000 Feet Deleted): Some of the values for total flights for each flight path are wrong, even though the overall total number of flights is correctly stated.

Appendix F (Aircraft Hazard Analysis), page F-28, Table F-12 Yearly Operations (77% General Aviation Below 18,000 Feet Deleted): The second column marked "Distance" has incorrect values for the orthonormal distances.

Appendix F (Aircraft Hazard Analysis), pages F-9 and Table F-9 on page F-24 contained typographical errors with virtually no significance.

The problem with the current analysis is that errors were made which, when added together, raise the aircraft crash probability an order of magnitude (reference c). The errors in the FSAR analysis are relatively minor with the exception of the estimates of the orthonormal distance to flight paths. This one error raises the overall crash probability approximately a factor of eight. The error resulted from a lack of precision in reading the 1:500,000 scale map of the area (only one available) coupled with a different reference point. The 1976 study was concerned with aircraft crash into Pantex Plant and measured the orthonormal distance to the center of the Plant. This problem was carried forward into the FSAR analysis. The Zone 4 FSAR analysis based orthonormal distances on the center of the Plant not the center of Zone 4.

### 3.0 RISK/BENEFIT OF CONTINUED OPERATION:

#### 3.1 Risk of Continued Operation

In this situation, although it has been determined that the FSAR analysis was inadequate, it is difficult to quantify the increased risk. Operations continue as they have for the last 40 years. The model used in the FSAR analysis, the Solomon model, has some limitations in its use as a predictive tool. It is generally agreed that the model is, at best, an order-of-magnitude model. Unreviewed safety question determination number PX-USQD-94-45 evaluated the increased probability of an aircraft crash into Zone 4 based on issues raised by various reviewers. By making corrections to the parameters found in the FSAR analysis, the crash probability increases from an FSAR value of  $1.85E-06$  to  $1.98E-05$ , roughly an order of magnitude.

Even though the probability for this calculation has apparently risen by a factor of ten, it is difficult to determine whether or not actual risk has changed. The FSAR analysis used very conservative assumptions in the modelling effort. The 1976 aircraft traffic data is deemed as being very conservative. Skid distances and impact areas are also seen as being conservative. The FSAR does not take any credit for pilot avoidance or the actual distance of Pantex from the Amarillo airport. It has been reported (Ref f and g) that the majority of accidents involving commercial aircraft occur within a 5-mile radius of the airport. The center of Zone 4 is approximately eight to nine miles from the FAA runway. Finally, the Solomon model does not account for altitude, which could ascribe the same crash probability for two jet aircraft flying over Zone 4, one 1500 feet above the restricted level and the other 25,000 feet above the Zone. The Solomon model does not represent the "state-of-the-art" in determining aircraft crash probability. Depending on which assumptions are used, one can readily change the results of the analysis.

Of the different data bases available (1976, 1989, or 48-day FAA effort), all contain different

numbers of overflight traffic. All data bases have questions as to their completeness and/or their pedigree. There is no positive evidence that any one contains better information than the others.

DOE produced the "Safety Evaluation Report DP SER 92-1" (Ref e) in December 1992. The purpose of this report was "to document, in summary form, the safety evaluation of plutonium pit interim storage and nuclear explosive staging in Zone 4 West at Pantex Plant." The results of this independent evaluation were "...the frequency of an aircraft crashing into a Zone 4 West magazine is exceedingly small (less than  $1E-7$  per year). This independent analysis demonstrates that the probability of an aircraft crash is actually about an order of magnitude lower than that reported in the FSAR."

Finally, a classified consequence analysis was completed by Sandia National Laboratory and was only briefly referenced in the FSAR (Ref h). The results of this consequence analysis indicate that in the event of a heavy military aircraft striking a magazine the consequences would be much less than those accepted in the Final Environmental Impact Statement design basis accident. For this and all the preceding reasons, it is difficult to quantify, whether or not an increase in the actual risk has really occurred.

### 3.2 Benefit of Continued Operation

The interim staging operations in Zone 4 cannot shut down. There is no current practical alternative to its use. When Rocky Flats Plant closed its doors for processing of plutonium, it stranded all the plutonium components awaiting shipment. National arms reduction initiatives require continuing dismantlement of retired nuclear explosives increasing the on-site inventory of special nuclear material. The nuclear explosives shipped to Pantex Plant for dismantlement cannot be returned to their base of origin because many of these military bases are closing.

A more poignant reason for continuing operations is the benefit associated with continuing dismantlement of nuclear explosives. The potential consequences which accrue to an accident with a full-up nuclear explosive are much greater than those of staged plutonium in pit form. Each dismantlement actually reduces risk by replacing a nuclear explosive with a staged pit.

The major benefit of continuing operations then, is that of continuing the dismantlement effort reducing our nuclear stockpile in accordance with arms reduction agreements. The perceived increase in risk shown by the Solomon model does not warrant slowing down actual risk reduction realized through continued dismantlements. The public, as well as the DOE, benefits from continuing the operations in Zone 4.

## 4.0 MITIGATIVE ACTIONS:

Several administrative actions and positive measures are planned during the period this JCO will be in effect. First, the DOE, in coordination with the FAA and the NRC, is planning to release a standard for conducting aircraft crash analysis. This would provide a state-of-the-art model for predicting aircraft crash probability. Given new and complete data, it would allow a recalculation of crash probabilities for Pantex Plant which will withstand scrutiny by any oversight group.

There are three different types of agreements in work between the FAA and the DOE. The first memorandum of understanding (MOU), which was signed January 3, 1995, is an agreement to allow the DOE to connect a radar airspace monitoring system (RAMS) to FAA radars to collect accurate data on air traffic in and around the Amarillo area. It will allow up to one year's worth of data collection the



first year and a shorter period of data collection in the ensuing four years. This will ensure that the DOE has the latest data for a recalculation of aircraft crash probabilities in conjunction with the Site Wide Environmental Impact Statement (SWEIS) currently underway. A local contractor, Tetra Tech, has the responsibility for providing the new aircraft crash analysis for the SWEIS. This analysis can also be used for the new modular FSARs which will follow the latest DOE form and content. It will eliminate the problem with the current Zone 4 FSAR in that the model is outdated and the data is old and uncertain. RAMS hookup is expected the week of January 9, 1995 and data collection would begin shortly thereafter.

The second agreement has also been signed by both parties. It is another MOU between the FAA and the DOE which provides general guidelines that each organization can follow to cooperatively reduce the flow of air traffic over Pantex. It involves discretionary procedures which air traffic controllers can use to route air traffic in such a manner as to avoid extended or unnecessary overflights of the plant. This radar vectoring will only be accomplished when safe and feasible. The second part of this MOU will have controllers use (again when safe and feasible) navigation fixes further away from the Pantex Plant for aircraft who request holding clearances for practice during instrument flight training. Finally, a hotline has been connected between the AAO's Emergency Operations Center and Security Command Post and the FAA's Terminal Radar Approach Control (TRACON) facility. Both parties to the MOU will establish mutual protocols for testing and operational use of the hotline. This MOU will help reduce the number of aircraft flying over Pantex and the hotline will enhance communications between the agencies when problems develop for either participant.

The third agreement is an interagency agreement, called a "Funds-out Interagency Agreement," in which DOE will provide funding to support FAA measures that will reduce the risk of aircraft crash into the Pantex Plant. The object of the FAA planned actions is to move two instrument approach paths used by aircraft inbound to Amarillo Airport's Runway 22 (the primary runway). As currently used, the Localizer Backcourse and the VORTAC approaches guide inbound aircraft almost directly overhead the Plant's Zone 4 storage areas. The first half of the 3 million dollars funding from the DOE will be used to install navigation antenna arrays to replace the Backcourse Localizer approach with an "Offset Localizer" approach. This new approach will move aircraft tracks more than one mile away from Zone 4. Completion date for this change is estimated to occur as early as December 1995. In the second phase of FAA improvements, the VORTAC navigation beacon, now located midway between the Plant and the airport will be replaced with a new beacon sited at the airport. After the beacon is physically shifted, the FAA can reorient approach paths up to 6 degrees (about 1.5 miles) farther away from the storage area. Target implementation date is December 1996. As an additional benefit, the new location of the VORTAC will allow the FAA to move high and low altitude airways for enroute aircraft 2 to 4 miles farther southwest of the Plant. In the final phase of modifications, the FAA has agreed to install a differential ground station for use with Global Positioning System (GPS) satellite navigation equipment. After the installation, the FAA will be able to implement a precision instrument approach to the airport that remains completely clear of the Plant's boundaries. The target date for this improvement is December 1998 and is considered as the single best long term positive measure for risk reduction.

At the last Overflight Working Group Meeting held December 1, 1994, Mr. Bret Simpkins, DOE's contractor (Tetra Tech) for the SWEIS, provided an analytical assessment of the quantitative reduction in risk that each alternative would realize. The initial MOU for vectoring, circling and the hotline would reduce the relative risk by about 13%. Implementing the offset localizer approach and moving the back course approach approximately one mile from Zone 4 is estimated to further reduce risk about 5%.

Moving the VORTAC onto the Amarillo airport is expected to have a significant impact further reducing the risk by about 55%. Finally, once the GPS precision approach is installed, estimating about 65% of the aircraft have GPS equipment (1998-2000) would further reduce the risk by an additional 8%. The total risk reduction for these measures is about 80% or almost an order of magnitude.

#### **5.0 EXPIRATION:**

This JCO will be effective until January 1, 1996 unless earlier revoked or superseded. The JCO will be revised as necessary when new information becomes available to ensure JCO currency. Since the JCO is intended to be a temporary authorization basis document until a new analysis is completed and/or positive measures are taken to reduce the risk an effective life of approximately twelve months will prevent unnecessary revisions to the document while allowing time to complete data collection and an upgraded analysis to support the Zone 4 FSAR revision. This JCO will be reevaluated during November and December 1995. If for any reason the Zone 4 FSAR revision is not completed by December 31, 1995, then the JCO will have to be updated and reissued prior to that time.

#### **6.0 JCO INVALIDATION:**

This JCO will be invalidated if:

- The work involving the revision of the Zone 4 FSAR is not completed prior to the expiration date established in this JCO.
- A new JCO is issued superseding PX-JCO-94-003.

Following the discovery of any of the above cases, this JCO will be invalidated and operations in Zone 4 shall cease.

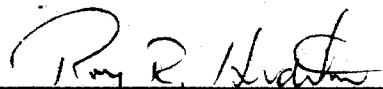
#### **7.0 CONCLUSION:**

Mason & Hanger concludes that the risk of continuing operations in Zone 4 is within the accepted safety envelope. The Solomon model, used to compute crash probability, is at best an order-of-magnitude model. The data used for the FSAR aircraft crash analysis is outdated. When all known errors found with the FSAR aircraft crash analysis are factored in, the result is an increase of an order of magnitude. This increase is predominately in the category of general aviation aircraft which are small and do not fly over Zone 4 as frequently as the larger aircraft. Recalculation of commercial and military aircraft crash probabilities still places the respective crash probabilities in the "incredible" category. One must weigh the compelling reasons for continuing operations against this poor aircraft crash analysis which could result in considering a shutdown. On the one hand, dismantlements contribute to real risk reduction whereas, the inadequate analysis coupled with a poor model cannot clearly demonstrate increased risk. When considering the upcoming events which will eradicate the historical problem with aircraft crash analyses, e.g. new standard, new and accurate data, plus the positive measures which are being effected between the DOE and the FAA to reduce the risk, the benefit of keeping Zone 4 open and operating far outweighs the real/perceived increase in risk by the discovery of the inadequate analysis.

## 8.0 REFERENCES

- a) "Pantex Plant Final Safety Analysis Report Zone 4 Magazines," Issue E, September 1993, (U).
- b) Pantex Plant Basis for Interim Operation (U), October 20, 1994.
- c) *Review of Aircraft Crash Probability Calculations in the Zone 4 Safety Analysis Report*, Rev. 1, December 15, 1994.
- d) Safety Evaluation No. PX-USQD-94-45, Zone 4 Aircraft Crash - New Information, December, 1994
- e) "Safety Evaluation Report DP SER 92-1," December 1992.
- f) USNRC Standard Review Plan NUREG-0800, Revision 2, July 1981.
- g) "Location of Commercial Aircraft Accidents/Incidents Relative to Runways," DOT/FAA/AOV 90-1, July, 1990.
- h) SRD Document, "Plutonium Dispersal Consequence Analysis of Hypothetical Aircraft Crash into Pantex Zone 4 (U)," (SAND 92-2217), December 1992.
- i) Final Environmental Impact Statement, Pantex Plant Site, October 1983.

Prepared By:

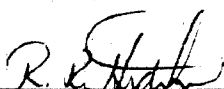


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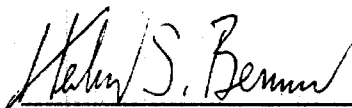
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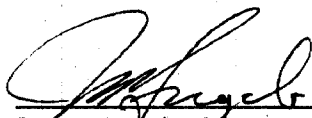
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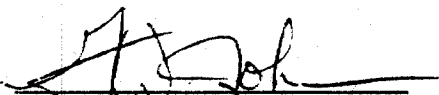


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