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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
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PRIVATE FUEL STORAGE, L.L.C.	)	Docket No. 72-22-ISFSI
	)	
(Independent Spent	)	
Fuel Storage Installation)	)	

NRC STAFF'S PETITION FOR COMMISSION REVIEW OF THE LICENSING BOARD'S PARTIAL INITIAL DECISION IN LBP-03-04 CONCERNING CREDIBLE ACCIDENTS

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March 31, 2003

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INTRODUCTION

Pursuant to 10 C.F.R. § 2.786(b), the staff of the Nuclear Regulatory Commission ("Staff") hereby files a petition for review of the Atomic Safety and Licensing Board's March 10, 2003, Partial Initial Decision (Regarding "Credible Accidents"), LBP-03-04, 57 NRC ___ (2003) ("Decision"). In accordance with 10 C.F.R. § 2.786(b)(4), the Staff submits that the Licensing Board's Decision (a) resolves an issue of fact in a manner that is clearly erroneous, (b) reaches a necessary legal conclusion that is without governing precedent and/or is contrary to established precedent, and (c) presents a substantial and important question of law and policy. Accordingly, for the reasons more fully set forth below, the Staff submits that the Commission should undertake review of, and overturn, the Licensing Board's Decision in LBP-03-04.

BACKGROUND

This proceeding concerns the application of Private Fuel Storage, L.L.C. ("PFS" or "Applicant"), for a license to construct and operate an Independent Spent Fuel Storage Installation (ISFSI) on the Reservation of the Skull Valley Band of Goshute Indians. Numerous contentions were filed by the State of Utah ("State") and other petitioners to intervene, including, in relevant part, Utah Contention K ("Inadequate Consideration of Credible Accidents") and Confederated

Tribes Contention B ("Lack of Protection Against Worst Case Accidents"). *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-98-7, 47 NRC 142, 190-91, 234-35 (1998). As admitted by the Licensing Board, the consolidated contention states (*Id*. at 253):

> The Applicant has inadequately considered credible accidents caused by external events and facilities affecting the ISFSI and the intermodal transfer site, including the cumulative effects of the nearby hazardous waste and military testing facilities in the vicinity and the effects on wildfires.

The Licensing Board resolved various portions of the contention during the course of this proceeding,[1] leaving certain specific aircraft crash issues to be resolved in an evidentiary hearing. In addition, the Board ruled that the threshold probability standard to be applied in determining whether aircraft crashes pose a credible hazard for an ISFSI is 1E-06 (*i.e*., 10^{-6}) per year, and it referred this portion of its ruling to the Commission for review. LBP-01-19, 53 NRC at 429-32, 456-57. On November 14, 2001, the Commission affirmed the Board's ruling as to the threshold probability standard to be applied in determining whether aircraft crashes pose a credible hazard for an ISFSI. *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-01-22, 54 NRC 416 (2001). Evidentiary hearings on this contention were then held in Salt Lake City, Utah on April 9-14 and May 13-15, 2002, and in Rockville, Maryland on July 1-3, 2002.

On March 10, 2003, the Licensing Board issued its decision in LBP-03-04, in which it resolved the remaining portions of this contention. Significantly, the Licensing Board found that the annual probability of F-16s crashing into the PFS facility exceeds the Commission's threshold criterion governing aircraft crash impacts at an ISFSI. *See* LBP-03-04, slip op. at 2. In doing so, the Board (a) rejected as unproven the Applicant's use of an "R" factor of 86%, which PFS used

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[1] *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-01-19, 53 NRC 416 (2001); *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-99-39, 50 NRC 232 (1999); *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-99-35, 50 NRC 180, 200-01 (1999).

to reduce the crash hazard calculated under the NUREG-0800 formula,[2] taking into account the probability that an Air Force pilot in a controllable emergency would take measures to successfully avoid crashing into the PFS Facility, (b) modified the values used by the Applicant for "N" and "w" under the NUREG-0800 formula, and (c) held that the Commission's threshold criterion of $1x10^{-6}$ established a precise threshold -- thereby rejecting the Staff's view that under NUREG-0800, Staff practice and NRC adjudicatory precedent, the Commission could find acceptable a calculated probability value that is "approximately" $1x10^{-6}$.

DISCUSSION

I. Legal Standards Governing Petitions for Review

Pursuant to 10 C.F.R. § 2.786(b)(4), Commission review of a Licensing Board decision may be undertaken in accordance with the following principles:

> (4) The petition for review may be granted in the discretion of the Commission, giving due weight to the existence of a substantial question with respect to the following considerations:
>
> (i) A finding of material fact is clearly erroneous or in conflict with a finding as to the same fact in a different proceeding;
>
> (ii) A necessary legal conclusion is without governing precedent or is a departure from or contrary to established law;
>
> (iii) A substantial and important question of law, policy or discretion has been raised;
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> (iv) The conduct of the proceeding involved a prejudicial procedural error; or
>
> (v) Any other consideration which the Commission may deem to be in the public interest.

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[2] NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (Rev. 2, July 1981) (PFS Exh. RRR). With respect to aircraft crash hazards, § 3.5.1.6 of NUREG-0800 ("Aircraft Hazards") provides an accepted methodology to estimate the probability of the crash of aircraft onto a nuclear power plant, using the formula: P (probability) = C (crash rate) x N (number of flights) x A (area of the facility)/ w (width of airway). LBP-03-04, slip op. at 15, 60, 115.

10 C.F.R. § 2.786(b)(4). *Accord, Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-01-09, 53 NRC 232, 234 (2001).[3]

II. The Commission Should Undertake Review of the Board's Decision.

For the reasons set forth below, the Staff submits that the Commission should undertake review of the Licensing Board's Decision under 10 C.F.R. § 2.786(b), insofar as the Board (a) incorrectly applied the Commission's annual threshold probability standard of $1x10^{-6}$, and (b) rejected the Applicant's use of an "R" factor to account for the undisputed likelihood that the pilot of a controllable crashing F-16 would take actions to avoid hitting the PFS Facility.

A. The Licensing Board Incorrectly Applied the Commission's Aircraft Crash Threshold Probability Standard of $1x10^{-6}$.

In its Decision, the Licensing Board held that the Commission's annual threshold probability standard set forth in CLI-01-22 constituted a precise value, which would not permit the acceptance of calculated probability values that are "approximately" $1x10^{-6}$. *See* LBP-03-04, slip op. at 76-79. This determination was critical to the Board's decision, in that it then calculated a probability value of $4.29x10^{-6}$, which the Board found impermissibly exceeds the Commission's $1x10^{-6}$ standard. *Id.* at 60. The Staff respectfully submits that the Licensing Board's legal conclusion that the Commission's annual threshold probability standard of $1x10^{-6}$ precludes acceptance of an application in which the probability is "approximately" $1x10^{-6}$, is without governing precedent and/or contrary to established precedent, and that it raises a substantial and important question of law,

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[3] Pursuant to the "clearly erroneous" standard in 10 C.F.R. § 2.786(b)(4)(i), the Commission generally declines to second-guess plausible Board decisions that rest on carefully rendered findings of fact, but will undertake review where the Board decision contains "obvious error." *See Dominion Nuclear Connecticut, Inc*. (Millstone Power Station, Unit 3), CLI-02-22, 56 NRC 213, 222 (2002); *Carolina Power & Light Co.* (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 382 (2001). Further, pursuant to 10 C.F.R. § 2.786(b)(4)(ii), the Commission may accept review where a necessary question of law is without legal precedent. *See Northeast Nuclear Energy Co.* (Millstone Nuclear Power Station, Unit 3), CLI-01-3, 53 NRC 22, 28 (2001) (Commission accepted review where interpretation of a regulation involved a question of law that was raised before and had the potential to be raised again in other proceedings).

policy or discretion -- in that it disregards the language of NUREG-0800, existing Staff practice and NRC precedent. Commission review of this aspect of the Board's Decision is therefore warranted.

In contrast to the Board's view, the Staff considers, consistent with existing practice and legal precedent, that the Licensing Board's calculated probability of 4.29×10^{-6} (which the Staff believes to be in error) would still meet the Commission's threshold probability standard. First, the language of NUREG-0800 establishes an aircraft crash probability standard of <u>approximately</u> 1×10^{-6}. Thus, NUREG-0800, § 2.2.3, provides that "the expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines of <u>approximately 10^{-6}</u> per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower." NUREG-0800, § 2.2.3. at 2.2.3-2; emphasis added.[4]

Second, Commission case law establishes that values somewhat larger than 1×10^{-6} may be considered to be "approximately" or "on the order of" 1×10^{-6} and therefore acceptable. For example, one Licensing Board has found that an annual aircraft crash probability of 2×10^{-6} was "approximately 1×10^{-6}" and was acceptable. *Consumers Power Co.* (Big Rock Point Plant), LBP-84-32, 20 NRC 601, 651 (1984), *aff'd sua sponte on other grounds,* ALAB-796, 21 NRC 1 (1985). *See also, Offshore Power Systems* (Manufacturing License for Floating Nuclear Power Plants), LBP-82-49, 15 NRC 1658, 1713 (1982), *aff'd sua sponte on other grounds*, ALAB-718, 17 NRC 384, 385 (1983) (probability of an aircraft crash resulting in consequences exceeding the guidelines of 10 C.F.R. Part 100 must be "of the order of 10^{-7} per year or less"); *Commonwealth Edison Co.* (Zion Station, Units 1 and 2), LBP-73-35, 6 AEC 861, 890-91 (1973), *aff'd on other grounds,* ALAB-226, 8 AEC 381 (1974) (annual crash probability of 5×10^{-6} in the event of a significant and unlikely future increase in airport usage was "sufficiently low so that no structural

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[4] NUREG-0800 would also permit acceptance of an application where the probability of an aircraft accident that results in radiological consequences greater than the 10 C.F.R. Part 100 dose limits is "less than <u>about</u> 10^{-7} per year." *See* PFS Exhibit RRR (NUREG-0800, Section 3.5.1.6), at 3.5.1.6-2 (emphasis added).

strengthening of the facility is required," and was covered by a license condition). *See also, Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit No. 2), ALAB-692, 16 NRC 921, 943-44 (1982) (the Standard Review Plan establishes a standard of "about 10^{-7} per year as a sufficiently low crash probability," and "[f]or events the estimated probability of which is of the order of 10^{-7} per year, there is virtually no hope that there will ever be sufficient data available to obtain a precise measured value."). [5]

Third, as stated in the testimony of NRC Staff witness Dr. Kazimieras Campe -- a co-author of the NUREG-0800 guidance on aircraft crash hazards, and an expert in aircraft crash analysis[6] -- it has been the Staff's long-standing practice to evaluate annual aircraft crash probability under a standard of "approximately" $1x10^{-6}$, and to assess the suitability of the proposed siting of a nuclear facility applying the probability acceptance threshold on an "order of magnitude" basis.[7] Thus, Dr. Campe testified that the criterion is expressed as an order of magnitude criterion -- *i.e.*, an approximate value. Tr. 8913. He further testified that typically, order of magnitude thresholds

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[5] *But see Metropolitan Edison Co.* (Three Mile Island Nuclear Station, Unit No. 2), ALAB-486, 8 NRC 9, 41-42, *aff'd and modified on other grounds,* CLI-78-19, 8 NRC 295 (1978) (finding a calculated probability of 2.3 x 10^{-7} "clearly exceeds the 10^{-7} limit").

[6] Dr. Campe was a principal contributor to NUREG-0800, Section 3.5.1.6. *See* Qualifications of Kazimieras M. Campe, at 1-2, attached to "NRC Staff Testimony of Kazimieras M. Campe and Amitava Ghosh Concerning Contention Utah K/Confederated Tribes B (Inadequate Consideration of Credible Accidents)" [hereinafter Campe/Ghosh], Post Tr. 4078 at 5-7. As the Board observed, Dr. Campe has 30 years of NRC and AEC experience assessing the risks posed by external man-made hazards to nuclear facilities -- and, "[a]s far as looking at the issues of aircraft hazards, along with all other site related hazards," Dr. Campe has "looked at almost every plant in the country." LBP-03-04, slip op. at 105, *quoting* Tr. 4090; *see* Tr. 4122 (Campe).

[7] The Licensing Board characterized the Staff witness' consideration of the standard on an order of magnitude basis to be a "changed" or "new litigating position." LBP-03-04, slip op. at 76-77 & n.99. There is no basis for that suggestion. Commission case law shows that nearly 20 years ago, Dr. Campe applied the same reasoning with respect to his review of aircraft crash hazards at the Big Rock Point Plant. *See Big Rock Point*, LBP-84-32, at 648 (Dr. Campe testified regarding the probability of the crash of military aircraft based on conservative assumptions to be "on the order of 10^{-6} ($7x10^{-7}$)" and for more realistic assumptions "the probability derived was on the order of 10^{-8} ($7.6x10^{-9}$)") (emphasis added).

are viewed as midpoints, such that 5 x 10^{-6} would be the dividing point between 10^{-6} and 10^{-5}. Tr. 8914, Tr. 8928-29 (4.9 x 10^{-6} is still within a 10^{-6} order of magnitude).

While the Licensing Board provided its reasons for rejecting this established guidance and Staff practice (LBP-03-04, slip op. at 76-79), it failed to cite any legal precedent in support of its conclusion -- although it was aware of the *Big Rock Point* decision's finding that 2 X 10^{-6} is equivalent to the "approximately 10^{-6} " standard established in NUREG-0800. *See* Tr. 4182-83 (Campe, Turk). Moreover, the Board's interpretation of a Staff guidance document, in a manner that contravenes the Staff's own interpretation of that document, threatens to disrupt the agency's well-established method and basis for licensing nuclear facilities. As such, the Decision raises a substantial and important question of law and policy, and warrants Commission review.

The Staff is cognizant, of course, of the Commission's decision in CLI-01-22, in which the Commission selected a threshold aircraft crash probability standard of "1x10^{-6} " as "sufficiently protective" for an ISFSI. CLI-01-22, 54 NRC at 263, 265. To be sure, the Commission did not express this standard as being "approximately" or "about" 1x10^{-6}. Rather, the Commission affirmed the Licensing Board's ruling that for an ISFSI, "the threshold probability for design basis events should be set at one in a million (1 x 10^{-6})." *Id.* at 265. However, in selecting this value, the Commission was essentially choosing between the 1x10^{-7} standard that applies to nuclear reactors and the 1x10^{-6} standard that it had recently applied to a geological repository operations area ("GROA") under 10 C.F.R. Part 60.[8] The Commission did not address the question of whether the

[8] The Commission took note of the Board's ruling in LBP-01-19, 53 NRC 416 (2001), "that the Commission had already indicated its intention that the design bases for Part 72 facilities and the surface operations of a geologic repository be 'comparable'." CLI-01-22, 54 NRC at 264. The Commission noted it had previously expressed "its intention to 'harmonize' Part 60 with Part 72," and to conform various sections of Part 60 to their counterpart sections of Part 72. *Id.* In this regard, in 1996, when the Commission amended the regulations in 10 C.F.R. Part 60 applicable to GROAs, it adopted a regulatory threshold of 1 x 10^{-6} per year in classifying "Category 2" events for such facilities. *See* Statement of Consideration, "Disposal of High-Level Radioactive Wastes in Geologic Repositories; Design Basis Events," 61 Fed. Reg. 64,257 (1996). Significantly, in that (continued...)

"$1x10^{-6}$" standard applicable to an ISFSI allows for acceptance of a calculated probability that is approximately $1x10^{-6}$. [9]

The Staff respectfully submits that clarification of this matter by the Commission would eliminate any doubt as to whether its decision in CLI-01-22 permits acceptance of an annual aircraft crash probability of "approximately" 10^{-6} for an ISFSI under 10 C.F.R. Part 72, and would help to resolve a substantial and important question of law and policy.

B. The Likelihood of Successful Pilot Avoidance

In LBP-03-04, the Licensing Board evaluated the Applicant's use of an "R" factor modifying the NUREG-0800 formula, to account for the likelihood that pilots would direct a crashing F-16 away from population centers or a facility on the ground.[10] While the Board concluded that this concept is not invalid, the Board found that the Applicant's prediction that such avoidance would occur in 95% of controllable crashes was contrary to the preponderance of the evidence.

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[8](...continued)
rulemaking, the Commission did not set a precise threshold as a standard, but, instead accepted "a lower bound for Category 2 design basis events on the order of 1×10^{-6} per year." *Id*. at 64,259 (emphasis added). *See also id.* at 64,265 ("Similarly, the Commission considers that the lower bound of Category 2 design basis events is on the order of 1×10^{-6} per year (i.e., events with probabilities of occurrence less than 1×10^{-6} per year would generally be screened from further consideration due to their negligible contribution to overall risk)"). The Staff notes that the standard established with respect to Yucca Mountain, as articulated in 10 C.F.R. Part 63, is more precise. *See* 10 C.F.R. § 63.2 (defining an "Event Sequence" for a Category 2 event as "hav[ing] at least one chance in 10,000 of occurring before permanent closure").

[9] In CLI-01-22, the Commission cited the *Big Rock Point* decision and its conclusion that a "conservative estimate of the cumulative aircraft hazards was approximately one-in-a-million, and there were reasonable arguments that the realistic probability of a crash was lower." *Id.* at 260 (emphasis added). The Commission did not state whether it would apply a similar "approximate" threshold value to an ISFSI under 10 C.F.R. Part 72 or a GROA under 10 C.F.R. Part 60.

[10] The "R" factor actually consists of two components: R_1 and R_2, the product of which establishes the value for R. Under this approach, PFS asserted that time and opportunity to control the aircraft (R_1) would be available in 90% of the F-16 crashes -- and that the percentage of time that a pilot in control of a crashing F-16 would take action to avoid the facility (R_2) could be set at 95%. The Licensing Board agreed with the Applicant's use of an R_1 factor of 90%, but found that a 95% probability of avoiding the Facility, given sufficient time and opportunity, was unsupported. LBP-03-04, slip op. at 30-31.

Specifically, the Board found that the evidence does not support "the notion that, for nuclear safety regulatory purposes, pilots under the special stress of an ejection-type situation can be counted on almost invariably to perform exactly as their training has prepared them to do" LBP-03-04, slip op. at 31 (emphasis omitted).[11] The Board concluded that use of an "R" factor with a value of 86% was not sustained -- and it therefore gave no credit whatsoever to any use of the R factor here.[12]

The Licensing Board's decision in this regard is clearly erroneous, in that its flat rejection of the Applicant's use of an 86% "R" factor disregards the undisputed evidence submitted by <u>all</u> parties -- that given time and opportunity (which the Board found would exist in 90% of the crashes), an F-16 pilot is more likely than not to take measures to avoid crashing into the PFS Facility. Even if the Board correctly determined that the evidence does not support an R_2 value of 95%, thus invalidating PFS's determination of an 86% reduction of the probability value, the Board should have considered what value to assign to the "R" factor, in light of the evidence introduced by all parties which demonstrates that F-16 pilots would avoid the PFS facility in controllable emergency situations. Thus, while the Licensing Board effectively assigned a value of zero probability to the pilot avoidance factor, the Staff submits that it should have assigned a number of at least 51% to R_2, to account for the likelihood that pilots in controllable crash situations would successfully take actions to avoid hitting the facility. *See* LBP-03-04, slip op. at 2, 18-44.

For example, the Applicant's panel of expert witnesses testified that Air Force pilots would steer and avoid the PFS facility if they had time and ability to control the airplane. Tr. 3776-78. The State's witness testified that he is "in complete agreement" that a pilot would intentionally avoid

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[11] The Licensing Board based this determination, in part, on the State's showing that in some circumstances, obstacles to avoidance would exist and that accident experience "establishes beyond doubt that human beings, under stress, fail." LBP-03-04, slip op. at 174. *See id*. at 35-38.

[12] In another context, the Board took cognizance of pilot behavior in selecting a value for "w", that reduced the available airway as calculated under NUREG-0800 from 10 miles to 6 miles, to reflect the air space width in which pilots predominantly fly. *See* LBP-03-04, slip op. at 59-60, 196-99.

the PFS site, given the right set of circumstances. Tr. 4229 (Horstman). F-16 pilot Col. Bernard testified that an Air Force pilot who has the ability to guide a crashing aircraft away from a ground target, would do that "almost all the time."[13] Tr. 3904-05. Further, the Staff's witness testified as to the Staff's inquiry into this matter, explaining that in a meeting with Hill Air Force Base ("AFB") personnel in September 2001, the Staff was informed that pilots are trained to and would strive to avoid ground sites in an emergency situation. Tr. 4186-89, Tr. 8931-32 (Campe).[14]

In light of this clear and undisputed evidence, the Licensing Board's effective assignment of a value of "0" to the probability of pilot avoidance in controllable situations was clearly erroneous. Rather, at a minimum, the Board should have found that pilots in a controllable emergency situation would successfully take actions to avoid hitting the PFS Facility in at least 51% of the crashes. This would result in an R factor of about 54%, calculated as $1- (R_1 \times R_2) = 1-0.90\times0.51 = 0.54$. Applying the Board's derived value of 4.29×10^{-6}, would result in a crash probability value of 2.32×10^{-6}.

CONCLUSION

For the reasons set forth above, the Commission should undertake review of, and overturn, the Licensing Board's decision in LBP-03-04.

Respectfully submitted,

/RA/

Catherine L. Marco
Sherwin E. Turk
Counsel for NRC Staff

Dated at Rockville, Maryland
this 31st day of March, 2003

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[13] Col. Bernard stated that "it's possible" that the pilot in a controllable situation would be preoccupied by engine restart efforts and pressured to eject such that the pilot would ignore the location where the plane might land -- but stated that while situations may exist where time does not permit avoidance actions, in his experience, "normally . . . a pilot tries to land the aircraft where it will do the least damage." Tr. 3926.

[14] In addition, a report prepared by the United Kingdom's Atomic Energy Authority relies on a pilot avoidance rate of 50%; the Licensing Board, however, discounted that report as "based on too crude an analysis." *See* Staff Findings at 21-22, PFS Exh. TTT.

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CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF'S PETITION FOR COMMISSION REVIEW OF THE LICENSING BOARD'S PARTIAL INITIAL DECISION IN LBP-03-04 CONCERNING CREDIBLE ACCIDENTS," in the above captioned proceeding have been served on the following through deposit in the NRC's internal mail system, with copies by electronic mail, as indicated by an asterisk, or by deposit in the U.S. Postal Service, as indicated by double asterisk, with copies by electronic mail this 31st day of March, 2003:

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