Department of Energy

Washington, DC 20585

OCT 2 3 1995

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

Dear Chairman Conway:

Thank you and your staff for focusing our attention on the structural degradation hazards in Buildings 776/777 and 771 at the Rocky Flats Environmental Technology Site (RFETS). Your letter dated August 3, 1995, addressed failure of both Department and contractor personnel to recognize the safety implications of known and apparent structural problems. The failure of the system for identifying, evaluating and correcting deficiencies and the potential for generic applicability to our aging facilities have become more apparent as we have investigated this concern. While our investigation is ongoing, this letter formally reports its status and our plans within the time frame you requested. This information was summarized in the briefings you received during your September 26, 1995, visit to RFETS.

You asked that we provide a report that identified safety implications, root cause and corrective actions for the problems and a plan to characterize the extent of damage. The enclosure contains direct responses to the specific issues addressed in your letter dated August 3, 1995. A root cause analysis addressing Rocky Flats Field Office's (RFFO) failure to recognize safety significance of the deficiency is attached to the enclosure. Also attached is a set of action plans and schedules to evaluate and correct deficiencies. Numerous related documents and reports are referenced and can be made available to your staff. Development of comprehensive corrective action plans, both for the Department and for its contractors, will not be final until: 1) completion of investigations into generic structural implications, mechanisms of damage, costs and priorities of possible corrective actions; 2) development of a process for continued evaluation of facilities; and 3) improvement of programs for the training, assignment and sensitization of personnel to recognize the need for full technical evaluation of material and operational deficiencies. We expect to complete these activities by mid-December 1995.

We are aware that Recommendations 90-5. and 94-3. as well as your letters dated December 20. 1993. and August 3. 1995. all address concerns over the current design and structural adequacy of our aging facilities for projected future use. As was presented to you in the briefings of September 26. 1995. we are planning to accelerate the stabilization of hazardous materials and the deactivation of the oldest and least capable facilities as a long term means of reducing the risks to workers and the public. We believe that this is the most prudent and reliable path to risk reduction while concurrently minimizing the long-term financial burden on the public.

We hope that your staff will continue to oversee our ongoing evaluation and will contribute to our correction of the problems in a timely fashion. We view their contribution in this matter to be most helpful. I encourage you to allow your staff to communicate informally their observations to Mr. Paul Golan (303-966-2879) of RFFO each time they inquire into this matter while on or off the site. I welcome your observations and ask that you continue to keep me advised of the Board's concerns.

This information is unclassified and suitable for placement in the public reading room.

Sincerely

for Thomas P. Grumbly
Assistant Secretary for
Environmental Management

Enclosure

Structural Issues at Rocky Flats

The following is a response to a letter from the Defense Nuclear Facilities Safety Board (DNFSB) dated August 3, 1995, about Rocky Flats facility structural integrity concerns. The DNFSB letter requests a report which addresses three items. The three items are quoted below with the responsive information following each:

- "Safety implications of the problem and its root cause, corrective actions to be taken to prevent a recurrence, and provisions for reviewing the safety implications of similar problems as they relate to all chemical processing facilities at RFETS."

Safety Implications of the Problem, and Corrective Actions:

An evaluation of data obtained from facility walk downs, initial concrete core samples, review of non-destructive testing results, and reviews of the structures by the Rocky Flats Environmental Technology Site (Site) and independent outside experts have been completed. Kaiser-Hill (KH) and the Rocky Flats Field Office (RFFO) judge the catastrophic collapse of the degraded portions of the Building 776/777 floor slab to be unlikely. The degraded portion of the floor does not pose an imminent safety hazard to workers or public. The concrete degradation and the failure to initially recognize the potential safety implications of the symptoms represent a concern that requires further attention and follow up. The Site's initial plan of action to perform this follow up includes the following:

1. Lithium chloride spills have been prevented by the draining and removal of lithium chloride solutions from air dryer units on site. This occurred during the 1990-91 time frame. Since July 1995, the chemical inventory of the Site has been reviewed, and bulk sources of lithium chloride removed from elevated storage areas with the exception of one previously opened lithium chloride drum that remains to be removed from Building 776/777. The drum is stored on the slab in Building 776/777 awaiting results of sample analysis. The analysis will determine whether the drum will be treated as excess chemical for disposal or disposed by normal waste processes. Lithium chloride now in concrete will dissolve in the presence of water or in high humidity, so the Site is further evaluating the mode of attack and transport mechanism for this chemical.

2. Administrative controls are in place in Building 776/777 to restrict personnel access in areas of concern (which includes areas above and below the observed degradation) and to avoid conditions which could initiate shear or flexural stress increases in areas of concern.

3. A potential Unreviewed Safety Question (USQ) was declared in Building 776/777 as the extent of the concrete degradation was difficult to adequately assess visually. The Site's initial assessments identified that the affected areas as less than 5 percent of the floor slab, and thus of minimal probable impact to the overall structure and primary containment. However, the indeterminate nature of the degradation mechanism has caused the Site to postulate that a portion of the floor slab above Room 430, nominally 10 feet by 10 feet, could separate from the ceiling, and fall through the overhead piping and conduit, damaging a glove box located below. The subsequent release was conservatively analyzed using maximum inventories in affected unsampled process lines (approximately 50 times the expected value). This analysis determined that releases could exceed the authorization basis for "anticipated" events.

   This analysis conservatively bounds the more credible partial failure of the slab. The partial failure might upset the existing ventilation pathways but all contamination would continue to be drawn through two stages of High Efficiency Particulate Air (HEPA) filters, minimizing any release. Partial or complete failure of the 10 foot by 10 foot slab does not affect the analyzed fire safety basis of the building since the slab is not a credited fire barrier. The safety credited features of this interior slab are being determined for use in the potential USQ evaluation. The Plan of Action projects this determination to be complete by December 13, 1995. The Site will attempt to complete this action earlier, but the schedule is dependent upon the results of field testing that could reduce or increase the amount of destructive testing required.

4. The Site is proceeding to structurally reinforce degraded areas in Building 776/777 to support the original design requirement of 200 lbs/square foot loading. Reinforcement will also contain potential concrete spalling that could injure workers and will permit the expanded concrete core sampling in the degraded areas as delineated in the Plan of Action. This action provides mitigation of any potential catastrophic collapse of degraded areas, and protects against the hazards that are being evaluated in the potential USQ.

5. Concrete testing of the second floor slab of Building 776/777 is being performed.

Previously completed testing has been expanded to include surface inspections, followed by NDT investigations. This data will be correlated with existing and new destructive testing data obtained by compression testing, chemical analysis, and petrographic examinations of concrete. Analysis will include a comparison of concrete from degraded and unaffected areas. This information will help evaluate mechanics of deterioration, extent of the damage, and potential consequences.

6. The contractor, KH, has initiated actions to evaluate hazards and identify near term-management actions to mitigate safety effects of the degradation. The contractor action plans are in the first attachment.

Review of Safety Implications of Similar Problems:

Several investigations and actions are ongoing or planned:

1. The "Historical Release Report for the Rocky Flats Plant" and the "Reconstruction of Historical Rocky Flats Operations & Identification of Release Points" reports are being reviewed and assessed against Portland Cement Association publications for spills of chemicals that could have affected structural concrete. These documents provide a detailed description of the processes that facilities used, as well as reported spills and releases that occurred to determine if there are other similar type of problems that are present in the facilities today.

2. Generic concerns such as the impacts of acid spills, adequacy of spill responses, and responses to future structural degradation issues are being evaluated. The existing chemical inventory is being reviewed for chemicals that appear to be in locations where spillage could degrade the structural integrity. The identified chemical storage locations will be inspected to determine if changes in storage methods or location are required. The chemical spill response procedures will be reviewed to determine if the described response and cleanup processes are adequate. A revision to the spill response procedures is expected. This revision will require that a structural assessment be performed after cleanup.

3. The contractor has initiated action plans to determine generic implications of chemical induced degradation to facilities site wide, and to a program for structure maintenance. These action plans are contained in the first attachment.

4. Rocky Flats has distributed a Safety Bulletin detailing the structural degradation conditions found in Building 776/777 to the rest of the DOE Weapons Complex.

Safety Implications of Root Cause and Corrective Actions:

The root cause of this incident and actions to prevent recurrence are currently being worked by both RFFO and KH. A root cause evaluation of failure to identify safety implications/significance of this condition was conducted by RFFO and is included as Attachment 2. To summarize the results, the root cause of this incident was that RFFO personnel did not comprehend or recognize the potential significance of the apparent symptoms. The indicated direct cause was RFFO personnel did not pursue a line of inquiry necessary to identify and report the significance of the structural damage. Technical inquisitiveness was not demonstrated. RFFO is developing a Corrective Action Plan based on these results that will be completed by October 20, 1995. Actions already taken included the following:

1. In order to increase its ability to oversee the contractor, and to adequately discern and understand technical issues, RFFO has significantly augmented the initial training, qualification, and continuing training programs of its Facility Representatives through a Plan of Action which was completed in September 1995. Activities already completed include:

   a. Revising the Qualification Standard to augment training on fundamentals, casualty response, and integrated facility operations.

   b. Appointment of a new Division Director of the Facility Operations Division, who has extensive Rocky Flats experience and qualified as a Shift Technical Advisor in Building 707. This individual was hired under DOE's Excepted Service Program. The Facility Operations Division, responsible for oversight of the nuclear facilities at the Site, now has twelve qualified Facility Representatives assigned full time to the plutonium and uranium facilities. Three more Facility Representatives are in

training. The RFFO believes they have appropriate staff to support a technically sound and inquisitive oversight program, which will also enhance information flow to the RFFO manager.

c. Assignment of mentors to Facility Representatives in training. Mentors were chosen from across the site based on nuclear experience and/or experience as qualified Facility Representatives. The mentor is expected to spend 2-4 hours per week with the candidate until that person is qualified. The benefit of this action is to facilitate the transfer of knowledge, information, and expectations in the qualification process.

d. Establishment of a continuing training program. Facility Representatives are required to attend weekly continuing training conducted by senior individuals from across the site. The benefit of this training is to focus attention on identified weakness (i.e., nuclear physics, radiation health effects, authorization basis, etc.) and emerging operational issues (i.e., structural integrity, thermal stabilization, RADCON manual requirements, etc.) to the Facility Representatives on a routine and continuing basis.

e. Weekly facility walk downs with the Assistant Manager for Facility and Material Stabilization with the Facility Representatives to review building status and evaluate the Facility Representative's technical competence and familiarity with their building.

2. RFFO is compiling "Facility Health Books" to document hazards, liabilities, and current conditions in nuclear facilities. In addition to documenting facility conditions, Health Books provide a "tickler" regarding key information and safety issues for a facility. For each issue, the facility is described as to area affected, sensitivity, effects, corrective actions required, compensatory measures implemented, and point of contact. Health Books also provide senior management a tool to regularly review facility hazards and to keep them aware of issues in nuclear facilities. In addition, these books are used in the training and qualification of DOE Facility Representatives. Health Books are in a preliminary stage of development at this time and will be maintained by the Facility Operations Division.

3. An improved communication network has been established which better links the Facility Operations Division with Health and Safety, Engineering, Nuclear Safety, etc.. Also, there is a wider distribution of occurrence notification reports from the Facility Operations Division to other RFFO organizations and the on-site DNFSB staff representatives as well as a bi-weekly summary of significant occurrences that Facility and Material Stabilization distributes across the Site.

A similar root cause analysis for failure to identify safety implications/significance, is being conducted by KH and is scheduled for completion on October 27, 1995. This analysis will examine multiple hypotheses including whether all elements of the needed system are present, whether the system relies heavily on the judgement of a single or few individuals who perform expert evaluations, whether structural issues are more technically challenging to evaluate than other emergent issues, and whether there is a shared expectation that existing issues have been properly evaluated, so that they do not need to be revisited. Corrective actions that have already been taken include:

1. KH has developed a process flow chart, Attachment 4, which depicts the process used to evaluate potential structural concerns. This process is being used to evaluate the structural issues identified in
Building 771.

   This process contains appropriate check points to evaluate the need for escalation of concerns. It will be included and described in text in the Programmatic Structure Maintenance Plan (PSMP). The PSMP will describe the method for determining priority of action plan recommendations. This prioritization of actions will take into account the future missions of facilities at the Site. The PSMP will consider the Material Condition and Aging Management guidance of DOE Standard 1073-93-Pt.2 *Guide for Operational Configuration Management Program including...Material Condition and Aging Management*..

2. As described above, the "Historical Release Report for the Rocky Flats Plant" and the "Reconstruction of Historical Rocky Flats Operations & Identification of Release Points" reports are being reviewed and assessed as is the adequacy of spill response procedures. In addition, the existing chemical inventory is being reviewed for

chemicals that appear to be in locations where spillage could degrade the structural integrity.

Complete results from the root cause and corrective action plans will be made available when concluded.

- "Corrective actions to be taken to ensure functional capability and operability of affected safety systems in the building."

As discussed above, the Site is proceeding to structurally reinforce degraded areas in Building 776/777 to prevent longer-term potential concrete spalling and mitigation of potential catastrophic collapse of the degraded areas. This reinforcement also protects against the hazards that are being evaluated in the potential USQ. Affected safety systems include overhead piping (possibly the fire suppression system), conduit (possibly the criticality alarm and monitoring system, fire detection system, SAAM system, etc.) and glove boxes/filter plenums (primary containment).

- "A plan that outlines the steps necessary to properly characterize the extent of the damage and safety ramifications of the degradation of the structural integrity of the floors and supported safety systems."

The Site is executing a program plan to characterize the extent of damage and safety ramifications of the degraded structural integrity of the floors and supported safety systems. The plan provides the actions necessary to determine the degradation mechanism, the extent of the damage, and the resulting safety implications of the condition when the potential USQ was declared. The concrete analysis results will provide the data necessary to complete the evaluation of the July 25, 1995, identified potential USQ. The action plan is contained in Attachment 1.

Safety ramifications are being assessed in the conservative analysis used in the potential USQ evaluation. The current configuration has been reviewed by an independent concrete structural expert. The concrete structural expert concurs with KH's assessment that Building 776/777 does not represent an immediate hazard. During the period while the planned actions are determining the degradation mechanism and extent, administrative controls and ongoing repairs provide protection which augments the safety basis. Emergent structural issues, *such*

as potential changes to these conditions due to continued degradation, will be detected by the building occupants and reported using the Occurrence Reporting or other applicable programs.

Safety systems are not directly affected by this degradation. Future postulated events, such as a potential partial slab failure, assume continued structural degradation. Potentially affected systems include the fire detection and fire suppression system, the criticality alarm and monitoring system, the SAAM system, and containment/ventilation systems. The Plan of Action to determine the affected area and degree of degradation will determine if the safety function or safety systems of the building structure were compromised. This information will be reported in the closure of the potential USQ declaration and the associated occurrence report.

KAISER·HILL

August 24, 1995 95-RF-06652

L. W. Smith
Assistant Manager for Facility and Material Stabilization
DOE, RFFO

KATHENE ISSUE IN BUILDING 776 - GMV-061-95

Ref: (a) L. W. Smith ltr (09664) to G. M. Voorheis, Same Subject, July 3, 1995

(b) G. M. Voorheis ltr, GMV-018-95 to L. W. Smith, Same Subject, July 12, 1995

(c) G. M. Voorheis ltr, GMV-036-95 to L. W. Smith, Same Subject, August 3, 1995

(d) G. M. Voorheis ltr, GMV-044-95 to L. W. Smith, Same Subject, August 7, 1995

PURPOSE
The purpose of this letter is to provide the status of the Kathene response action plans as of August 24, 1995.

BACKGROUND
Degradation of steel decking and concrete has existed in Building 776/777 in localized areas of the second floor slab and was identified and reported by the previous contractor. This deterioration potentially has resulted from excessive heat associated with the fire in 1969 and spillage over the years of Kathene (lithium chloride) from Kathabar units previously used at the site for air drying purposes. Kathabar units were used as part of the building dehumidification system during the years 1965 through 1990. These units have been taken out of service, the lithium chloride (Kathene) charge drained from the system and, in many cases, systems have been flushed and cleaned out. The units themselves have not been physically removed. Walkdowns of the second floor reveal concrete degradation appearing to emanate from the vicinity of the units.

On July 3, 1995, Kaiser-Hill received a letter from DOE, RFFO, Reference (a), requesting that we conduct a comprehensive evaluation of the condition of concrete deterioration of Building 776/777. DOE, RFFO requested that Kaiser-Hill answer a number of Kathene-related questions to provide better definition of the nature of the problem and to provide a Plan of Action (POA) for characterizing and resolving the identified concerns. Kaiser-Hill responded in Reference (b) with answers to the specific questions and a preliminary POA. Subsequently, References (c) and (d) provided amplification of this POA.

SUMMARY AND CONCLUSIONS
Based on the implementation of these POAs and independent outside expert reviews, Kaiser-Hill remains convinced that the degraded concrete condition in Building 776/777 is not an imminent hazard because catastrophic collapse of the degraded portions of the floor slab is judged to be unlikely. However, we continue to evaluate the condition as POA tasks are completed. Based on completed actions, we continue to confirm that there is no unnecessary risk to the public or co-located worker.

Kaiser-Hill Company, L.L.C.
Courier Address: Rocky Flats Environmental Technology Site, State Hwy. 93 and Cactus, Rocky Flats, CO 80007 • 303-966-7000
Mailing Address: P.O. Box 464, Golden, Colorado 80402-0464

The dates and actions included reflect: 1) the results of planning for concrete core sample removal and the subsequent analysis by the forensic concrete experts (Construction Technology Laboratories); 2) tripling of amount of subflooring installation to allow concrete core removal (recommendation of the concrete structural expert); and 3) the subsequent project conversion to a Davis-Bacon coverage activity with the associated mobilization schedule.

The attached POAs presents the specific tasks that have been or are being implemented to eliminate the observed concrete deterioration in Building 776/777. They also present Kaiser-Hill's longer term strategy for resolving concrete structural deterioration at Rocky Flats Environmental Technology Site (SITE) resulting from prior spills of corrosive/intrusive chemicals.

RESPONSE REQUIREMENTS
No response to this memo is required. Should you have any questions, please contact Leon McGovern at X4874.

G. M. Voorheis
Vice President
Special Material Management Integration

CONCURRENCE:

8-24-95

E. L. Evans Date
Director
Engineering and Construction

PFEisak

Orig. and 1 cc - L. W. Smith

Attachment:
As Stated

PLAN OF ACTION
EFFECTS OF KATHENE AND OTHER CHEMICALS ON STRUCTURAL INTEGRITY OF ROCKY FLATS BUILDINGS

PERSONNEL SAFETY AND IMMEDIATE MANAGEMENT ACTIONS:

Objective: Confirm the hazard associated with the 2nd-floor concrete, and define the hazard mitigation actions to be taken for the protection of personnel and equipment, and other near-term management actions.

This plan addressed immediate concern assessment of Building 776/777 2nd-floor slab structure integrity. Its objective is to confirm the general condition of the slab and establish priority of this facility's condition relative to other facilities at RFETS with similar Kathene-spill histories and to take immediate actions to safeguard personnel safety and protect property within the facility.

Two additional Plans of Action (POAs) are also in preparation. These Plans of Action are: 1) Perform a disciplined and detailed analysis of the current condition of Building 776/777 relative to 2nd-floor slab integrity and propose recommended corrective actions which are necessary and sufficient to protect personnel, property and public safety for the duration of the facility's planned mission. 2) Concurrently investigate similar occurrences (spills) at RFETS and assess generic structural implications associated with these spills.

All information obtained to date has consistently supported and confirmed the proposed Plan of Action.

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
1.	**Task:** Perform independent expert structural reviews of available data and perform visual inspections to prioritize areas of highest concern in Building 776/777 and to identify those which require immediate attention to minimize the potential for structural failure in local regions. **Deliverable:** Verbal exit interview notes, to be confirmed by final Trip Report of the retained concrete structural expert (CSE). **Comment:** Confirmed initial areas of concern are over Rooms 154 and 430 and imminent collapse is not likely in the absence of initiating events such as a seismic event, other extreme NPH, or significant floor vibrations induced by improper equipment operations.	L. McGovern	Completed 7/27/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
2.	**Task:** System Engineers walkdown Building 776/777 to determine material and systems at risk. **Deliverable:** Memo containing notes of walkdown identifying utilities or systems at risk. **Comment:** Provided initial assessment for Task 3 review.	H. Saunders	Completed 7/17/95
3.	**Task:** Perform preliminary conservative safety significance study using bounding postulated failure scenario of a 2nd floor slab section. **Deliverable:** Preliminary calculation documents. **Comment:** Although the preliminary calculations indicate postulated dose rates are comparable to the existing Authorization Basis for Building 776/777, due to the preliminary nature of the analysis, DOE, RFFO has been informed that a potential USQ exists.	N. Cathey	Completed 7/25/95
4.	**Task:** Extract core borings in the three graded regions identified by the Olson Report to obtain visual assessment of degradation to support site and expert assessment of structural condition. **Deliverable:** Photographic prints of three cores correlated to the Olson Report (Figure 1) coordinates. **Comment:** Borings showed concrete integrity corresponding to NDT results.	L. McGovern	Completed 7/22/95
5.	**Task:** Obtain Kathabar Manufacturer's information on manufacture, additives, and corrosive properties to determine expected corrosion properties, for use in evaluation of observed degradation. **Deliverable:** Fact sheets or notes of telecon copied to L. McGovern. **Comment:** Data sheet showed LiCl corrosion of reinforced concrete should be expected if not protected due to chloride attack on steel.	L. McGovern	Completed 7/11/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
6.	**Task:** Obtain Portland Cement Association (PCA), American Concrete Institute (ACI), and Construction Technology Laboratories (CTL) Lithium Chloride corrosive properties data bases for use in evaluation of observed degradation. **Deliverable:** Fact sheets or notes of telecon copied to L. McGovern. **Comment:** Previous corrosion history was not found on file by these organizations, however they reported LiCL corrosion may mimic road salt effects.	L. McGovern	Completed 7/13/95
7.	**Task:** Perform chemical analysis of cores from Task 4 to obtain preliminary assessment of chloride, chromate, and pH levels in each area to support expert assessment of structural condition. **Deliverable:** Laboratory report on chemical analysis for each core. **Comment:** Levels of chlorides and lithium were found to be increasing corresponding to level of core deterioration. Chromates were found in all samples.	L. McGovern	Completed 7/27/95
8.	**Task:** Implement Shift Order to provide administrative controls necessary to restrict personnel access in areas of concern and to avoid conditions which could initiate shear or flexural stress increases in areas of concern. **Deliverable:** Shift Order 776-95-01, Rev. 9 **Comment:** Area access and loading restrictions have administratively minimized immediate hazards to personnel and equipment from concrete deterioration.	W. Franz	Completed 7/15/95
9.	**Task:** Remove Kathene product drums from 2nd floor to eliminate bulk sources available for further spills. **Deliverable:** Memo from W. Franz stating completion of removal. **Comment:** Bulk Kathene removal eliminates future Kathene spills initiating additional corrosion.	W. Franz	Completed 7/14/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
10.	**Task:** Walkdown review of Kathabar areas in other Facilities at RFETS to verify current condition is of lesser concern than Building 776/777. **Deliverable:** Walkdown notes from Buildings 707 and 779 with summary assessment of visual condition relative to Building 776/777. **Comment:** Walkdowns confirmed priorities established in Tasks 1 and 2. Structural corrosion staining was observed in both buildings 707 and 779 and will be evaluated in the generic implication POA. Due to prestressed reinforcement in Building 707, priority review by CTL is scheduled.	L. McGovern	Completed 8/24/95
11.	**Task:** Review final Trip Report of the retained CSE to ensure remaining actions are consistent with documented CSE opinion. **Deliverable:** Memo stating required changes. **Comment:** Provided recommendations for one additional area (Task 20) and expansion of the subflooring coverage.	L. McGovern	Completed 8/10/95
12.	**Task:** Review and modify, as necessary, current sub-flooring design over Rooms 154 and 430 to allow immediate installation. **Deliverable:** Reissue EO37402. **Comment:** Design completed 8/3/95 and EO issued for distribution on 8/10/95.	H. Saunders	Completed 8/03/95
13.	**Task:** Design standard sub-flooring (200 lbs./sq. ft. design loading) package for future use in additional areas identified as needing sub-flooring. (eg Room 127 and 134). **Deliverable:** Issue Engineering Order **Comment:** EO37542 available for use.	H. Saunders	Completed 8/8/95
14.	**Task:** Complete installation of sub-flooring (200 lbs./sq. ft. design loading) over Room 430, for original scoped areas(provides contingency support under severly rusted decking). **Deliverable:** Report of acceptance inspection of installation in Room 430. **Comment:**	L. McGovern	8/31/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
15.	**Task:** Modify existing installed sub-flooring (200 lbs./sq. ft. design loading) over Room 154 as necessary, based on Task 12. **Deliverable:** Report of acceptance inspection of installation in Room 154. **Comment:**	L. McGovern	9/15/95
16.	**Task:** Develop and implement corrective action for RCRA/structural remediation of area over Room 127. **Deliverable:** Report of acceptance inspection of installation in Room 127. **Comment:**	L. McGovern	9/28/95
17.	**Task:** Develop detailed Plan of Action to conduct a disciplined analysis of the mechanism of attack, extent of degradation, and potential corrective actions. **Deliverable:** Plan of Action, including project logic diagram. **Comment:** Delivered in letter 95-RF-06260, G.M. Voorheis to L. W. Smith.	L. McGovern	Completed 8/07/95
18.	**Task:** Develop detailed Plan of Action to conduct a disciplined analysis of the generic implications due to Kathene or other chemical spills at RFETS. **Deliverable:** Plan of Action, including project logic diagram. **Comment:** Delivered in letter 95-RF-06260, G.M. Voorheis to L. W. Smith.	L. McGovern	Completed 8/07/95
19.	**Task:** Conduct Root Cause Analysis of programmatic issues surrounding this occurrence. **Deliverable:** Root Cause Analysis Report **Comment:**	T. Buhl	9/29/95
20.	**Task:** Complete subflooring installation over Room 134 in response to concrete strutural expert review. **Deliverable:** Report of acceptance inspection of installation in Room 134. **Comment:**	L. McGovern	10/15/95

PLAN OF ACTION

EFFECTS OF KATHENE AND OTHER CHEMICALS ON STRUCTURAL INTEGRITY OF ROCKY FLATS BUILDINGS

ACTIONS TO DETERMINE CONCRETE DEGRADATION ROOT CAUSE AND PATH FORWARD:

OBJECTIVE: Determine the root cause of the concrete degradation and produce a proposed path forward plan for hazard mitigation based upon the building and site missions. This plan specifically investigates Building 776/777 conditions. The plan will include actions to be taken for the protection of personnel and material, including the co-located worker and the public, and for compliance with RCRA and OSHA regulations. Tasks to identify the generic implications of spills are included in the Generic Implication Plan of Action.

The tasks are organized into five task sets for purposes of organization. They are:

Tasks 1- 9	Set 1-Data Collection and Assessment
Tasks 10-14,31,32	Set 2-Site Physical Sampling
Tasks 15-17	Set 3-Data Correlation
Tasks 18-22	Set 4-Structural/Loading Analysis
Tasks 23-30	Set 5-Graded Path Forward Implementation

This plan includes the actions necessary to complete the evaluation of the potential USQ declared on August 2, 1995.

If, during the implementation of this plan, actions are identified that need to be completed on a more aggressive schedule are identified, those actions will be started and the plan modified appropriately. All activities completed to date have consistently confirmed the proposed plans of action are appropriate.

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
	Task Set 1-Data Collection and Assessment		
1.	**Task:** Obtain results of Non Destructive Testing of concrete in Building 707 Kathene spill areas. **Deliverable:** Olson report entitled "Nondestructive Testing Investigation, Concrete Integrity Evaluation, Second Floor Building 707, Rocky Flats Plant, Golden Colorado" dated June 8, 1990. **Comment:** Report states concrete in generally good condition and quality. Some delamination of the concrete topping on the twin-tee flanges was indicated.	L. McGovern	Completed 7/17/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
2.	**Task:** Contact other Kathabar users to understand operating experiences (DOE & Industry). **Deliverable:** Telecon notes. **Comment:**	L. McGovern	8/31/95
3.	**Task:** Evaluate "Report on Investigation of fire Building 76-77, Rocky Flats Plant, Golden Colorado, May 11, 1969" for potential fire heating or flame contact relative to corrosion locations. **Deliverable:** Floor plan overlay map of potential fire affected areas. **Comment:** Several Kathabar units were over the fire damaged area. Temperatures from the fire were sufficient to potentially affect concrete. Core sample thin sections will be evaluated to determine if the concrete was affected.	B. Campbell	Completed 8/21/95
4.	**Task:** Evaluate post fire decontamination processes (including potential acid use) to corrosion sites. **Deliverable:** Floor plan overlay map of potential acid decontamination affected areas. **Comment:** Building 776 decontamination protocols were and are the same as used in other buildings. No bulk acid decontamination outside gloveboxes could be verified, although hydrochloric acid was used inside some gloveboxes. No floor plan overlay was produced since there were no acid decontaminated floor areas, therefore the report of the investigation will be used as the deliverable.	L. McGovern	Completed 8/21/95
5.	**Task:** Produce overlay mapping of the Building 776 2nd floor, which includes locations of structural steel, rust or corrosion coverage, equipment locations and observed concrete surface defects, for incorporation into the "Concrete Sampling, Testing and Evaluation Plan" (CSTEP). **Deliverable:** Baseline overlay maps. **Comments:**Overlays were provided to Construction Technology Laboratories.	C. Caimi	Completed 8/21/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
6.	**Task:** Initial "Concrete Sampling, Testing and Evaluation Plan" (CSTEP) submitted by the Forensic Concrete Testing firm. **Deliverable:** Copy of Initial Plan. **Comment:** The plan as provided identified a technique that could potentially minimize the duration and cost of the NDT testing, which accelerates the core sampling schedule.	K. Griffin	Completed 8/10/95
7.	**Task:** Expert Structural Peer Review (ESPR) of results to date and the "Concrete Sampling, Testing and Evaluation Plan" to confirm scope and direction is appropriate. **Deliverable:** Memo of Review and comments. **Comment:** Concrete Structural Expert essentially concurred with the plan with minor comments.	B. Evans	Completed 8/14/95
8.	**Task:** Revise the CSTEP as necessary from ESPR Review to incorporate comments. **Deliverable:** Revised plan for implementation. **Comment:** The comments were incorporated as appropriate.	K. Griffin	Completed 8/16/95
9.	**Task:** Prepare Baseline Change Proposal to fund "Kathene Evaluation." (i. e. known expenditures resulting since July 3, 1995 plus the mitigation and evaluation activities associated with the Kathene issue at RFETS). **Deliverable:** BCP for submittal to the Site Change Control Board for approval. **Comment:** Funding is budgeted for the remainder of fiscal year 1995.	K. Griffin	Completed 8/11/95

K TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
Set 2-Site Physical Sampling		
Task: Measure slab integrity for areas identified in the CSTEP using the ASTM "Chain Test" supplemented by Impact Echo Analysis. **Deliverable:** Overlay map displaying test results. **Comment:**	K. Griffin	9/29/95
Task: Obtain core samples from room 154 and others as described in the CSTEP. **Deliverable:** Core samples in accordance with the CSTEP delivered to laboratory. **Comment:**	K. Griffin	10/20/95
Task: Perform compression tests of concrete cores as described in the CSTEP. **Deliverable:** Compression test data sheets. **Comment:**	K. Griffin	11/27/95
Task: Analyze metal and concrete samples as described in the CSTEP for chlorides, pH, chromates, sulfates etc. **Deliverable:** Analysis data sheets for each sample. **Comment:**	K. Griffin	11/27/95
Task: Prepare and analyze thin section of concrete and metal as described in the CSTEP. **Deliverable:** Photographs and written analysis for each sample. **Comment:**	K. Griffin	11/27/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
	Task Set 3-Data Correlation		
15.	**Task:** Evaluate the NDT measurements with chemical analysis, core thin sections and compression test results to determine if NDT correlation to concrete condition is possible. **Deliverable:** Analysis report for inclusion in the Structural Report. **Comment:**	K. Griffin	12/11/95
16.	**Task:** Determine areas of concrete or rebar degradation and rate of degradation. Overlay existing and projected degradation on previous baseline mapping. **Deliverable:** Overlay maps of degradation and projected degradation. **Comment:**	K. Griffin	12/1/95
17.	**Task:** Perform a root cause determination of the observed concrete and rebar degradation mechanisms for use in the structural analysis and hazard mitigation plan. **Deliverable:** Written results of the root cause determination process. **Comment:**	T. Buhl/ K.Griffin	12/7/95
	Task Set 4-Structural/Loading Analysis		
18.	**Task:** Determine the functional requirements of the 2nd floor slab based upon the existing authorization basis. This will be used to evaluate the declared potential USQ. **Deliverable:** Memo transmitting the functional requirements. **Comments:**	C. Caimi	9/1/95
19.	**Task:** Using the data produced, evaluate the ability of the 2nd floor slab to satisfy the authorization basis requirements. **Deliverable:** Written evaluation for inclusion in the structural report. **Comment:**	K. Griffin	12/11/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
20.	**Task:** Complete a Safety Analysis, using the functional requirements evaluation, determine the effect of the actual concrete degradation and its impact on Building 776 authorization basis. **Deliverable:** Completed USQD. **Comment:**	G. Zimmerman	12/13/95
21.	**Task:** Complete notification of RFFO regarding the potential USQ declared on August 2, 1995. **Deliverable:** Memo to DOE/RFFO stating status of USQ issue. **Comment:**	G. Zimmerman	12/15/95
	Task Set 5-Graded Path Forward		
22.	**Task:** Determine the future mission requirements for Building 776, particularly the degradation affected area, for use in the Programmatic Structure Maintenance Plan (PSMP). **Deliverable:** Memo stating Mission space requirements and durations. **Comments:**	W. Franz/ E. Lee	12/1/95
23.	**Task:** Determine the functional requirements of the 2nd floor slab based upon the projected remaining mission authorization basis. This will be used to evaluate the installed repairs. **Deliverable:** Memo transmitting the functional requirements. **Comments:**	C. Caimi	12/5/95
24.	**Task:** Provide a scope to remove the Kathabar units. **Deliverable:** Written scope of work. **Comment:**	C. Caimi	10/1/95
25.	**Task:** Provide a cost estimate to remove the Kathabar units using the scope from the previous task. **Deliverable:** Written estimate for removal. **Comment:**	N. Sproles	11/1/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
26.	**Task:** Perform an evaluation of the present leak-control effectiveness of the existing drained, flushed and out of service condition. **Deliverable:** Memo stating current and potential leakage impacts. **Comment:**	C. Caimi	11/1/95
27.	**Task:** Perform independent reviews of the structural calculations for repairs in Rooms 127, 154, and 430 for adequacy to restore functional requirements capability for the projected mission as defined in an earlier task. This will confirm the resolution of the potential USQ is maintained in the future. **Deliverable:** Memo containing record of review and results of review. **Comment:**	C. Caimi	12/1/95
28.	**Task:** Issue Structural Report containing Task Set 4 results including recommendation for High priority and programmatic repairs or upgrades. **Deliverable:** Structural Report **Comment:**	L. McGovern/ C. Caimi	2/2/96
29.	**Task:** Forward the Structural Report recommendations into the Programmatic Structure Maintenance Plan (PSMP). **Deliverable:** Memo of transmittal. **Comment:**	L. McGovern	2/13/96
30.	**Task:** Prepare "Kathene Issue Resolution Report" for potential distribution DOE Complex-wide as a "Lessons-Learned" information notice. **Deliverable:** Report and letter of transmittal to DOE/RFFO. **Comment:**	B. Evans	2/28/96

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
31.	**Task:** Install expanded subflooring coverage in Room 154 to preclude potentially influenced area concerns, assuming continued degradation of the second floor slab. **Deliverable:** Report of acceptance inspection of installation in Room 154. **Comment:**	L. McGovern	9/28/95
32.	**Task:** Install expanded subflooring coverage in Room 430 to preclude potentially influenced area concerns, assuming continued degradation of the second floor slab. **Deliverable:** Report of acceptance inspection of installation in Room 430. **Comment:**	L. McGovern	10/15/95

PLAN OF ACTION

EFFECTS OF KATHENE AND OTHER CHEMICALS ON STRUCTURAL INTEGRITY OF ROCKY FLATS BUILDINGS

ACTIONS TO DETERMINE GENERIC IMPLICATIONS OF SPILLS SITEWIDE:

OBJECTIVE: Investigate historic and potential spills sitewide to determine the generic structural implications for input to the Programmatic Structure Maintenance Plan (PSMP)." This plan investigates site impacts other than Building 776/777.

If, during the implementation of this plan, actions are identified that need to be completed on a more aggressive schedule are identified, those actions will be started and the plan modified appropriately.

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
1.	**Task:** Perform a review of kathene Spill areas in 707 and 779 to identify any 1) High priority mitigation requirements or 2) Programmatic mitigation requirements. **Deliverable:** Memo stating results of the review. **Comment:**	L. McGovern	8/24/95
2.	**Task:** Perform a review of the "Historical Release Report for the Rocky Flats Plant" to identify potential spills of liquid that could impact structures on site. **Deliverable:** Memo stating results of review and listing chemicals involved in the spills of significance. **Comment:**	L. McGovern	9/15/95
3.	**Task:** Perform a review of the "Reconstruction of Historical Rocky Flats Operations & Identification of Release Points" report to identify potential spills of liquid that could impact structures on site. **Deliverable:** Memo stating results of review and listing chemicals involved in the spills of significance. **Comment:**	L. McGovern	9/15/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
4.	Task: Produce a listing of all liquid chemicals in quantities greater than 5 gallons. **Deliverable:** Listing from the chemical inventory database. **Comment:** Dated August 2, 1995, there were 2056 containers out of 55,000 plus entries.	D. Costain	Completed 8/7/95
5.	Task: Evaluate the chemicals (including brines) listed in Tasks 2, 3 and 4 for concrete effects. **Deliverable:** Memo stating name, volume and location of each chemical that would attack re-enforced concrete. **Comment:**	L. McGovern	10/4/95
6.	Task: Perform, prioritized by hazard, a review of Systems and Components potentially impacted by the chemicals identified in Task 5. **Deliverable:** Memo stating proposed remediation for all chemicals that appear to represent high hazards in their facility locations. **Comment:**	L. McGovern	11/1/95
7.	Task: Issue Generic Implications Report (GIR) including recommendations for future actions for inclusion in the "Programmatic Structure Maintenance Plan (PSMP)." Deliverable: Generic Implications Report. Comment:	L. McGovern	11/15/95
8.	Task: Perform a Safety Screen/USQD of the Generic Implication Report. **Deliverable:** Safety Analysis/USQD of the GIR. **Comment:**	G. Zimmerman	11/30/95
9.	Task: Expert Structural Peer Review (ESPR) of results to date and the Generic Implication Report. **Deliverable:** Memo of Review and comments. **Comment:**	B. Evans	12/5/95
10.	Task: Transmit GIR and Building 707 recommendations into the Programmatic Structure Maintenance Plan (PSMP). **Deliverable:** Memo of transmittal. **Comment:**	L. McGovern	12/24/95

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
11.	**Task:** Concrete forensic experts perform Building 707 Top/Underside Inspection. **Deliverable:** Inspection Report. **Comment:**	K. Griffin	10/20/95
12.	**Task:** Issue the "Assessment/Recommendation Report for Building 707" for Expert Structural Peer Review (ESPR) with the GIR in Task 9. **Deliverable:** Memo of transmittal. **Comment:**	K. Griffin	11/10/95

PLAN OF ACTION

EFFECTS OF KATHENE AND OTHER CHEMICALS ON STRUCTURAL INTEGRITY OF ROCKY FLATS BUILDINGS

ACTIONS TO PRODUCE THE PROGRAMMATIC STRUCTURE MAINTENANCE PLAN (PSMP):

OBJECTIVE: Produce a Site path forward plan for hazard mitigation based upon the building and site missions. The plan will include actions to be taken for the protection of personnel and material, including the co-locatec worker and the public, and for compliance with RCRA and OSHA regulations. Tasks to disposition the generic implications of spills are included as direction for structural responses in the event of future spills.

If, during the implementation of this plan, actions are identified that need to be completed on a more aggressive schedule are identified, those actions will be started and the plan modified appropriately.

All activities completed to date have consistently confirmed the proposed plans of action are appropriate.

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
1.	**Task:** Evaluate for inclusion in the Programmatic Structure Maintenance Plan (PSMP) the Structural Report recommendations and provide closure for these recommendations. **Deliverable:** Letter stating how each recommendation is dispositioned in the Programmatic Structure Maintenance Plan (PSMP). **Comment:**	L. McGovern	2/16/96
2.	**Task:** Evaluate for inclusion in the Programmatic Structure Maintenance Plan (PSMP) the Generic Impacts Report recommendations and provide closure for these recommendations. **Deliverable:** Programmatic Structure Maintenance Plan (PSMP). **Comment:**	L. McGovern	2/16/96

TASK NO.	TASK DESCRIPTION	RESPONSIBLE MANAGER	DUE DATE
3.	**Task:** Produce for inclusion in the PSMP a process plan for dealing with structural concerns including post spill responses. **Deliverable:** Programmatic Structure Maintenance Plan (PSMP) Process Section. **Comment:**	L. McGovern	1/5/96
4.	**Task:** Issue the PSMP that dispositions the Structural Report and Generic Impacts Report recommendations. **Deliverable:** Programmatic Structure Maintenance Plan. **Comment:**	L. McGovern	2/23/96
5.	**Task:** Expert Structural Peer Review (ESPR) of results to date and the PSMP to confirm scope and direction is appropriate. **Deliverable:** Memo of Review and comments. **Comment:**	B. Evans	2/28/96
6.	**Task:** Revise the PSMP as necessary from ESPR Review to incorporate comments. **Deliverable:** Revised plan for implementation. **Comment:**	L. McGovern	3/1/96
7.	**Task:** Prepare Baseline Change Proposal to fund Programmatic Structure Maintenance Plan (i. e. the remaining known expenditures associated with the mitigation of the Kathene issue at RFETS). **Deliverable:** BCP for submittal to the Site Change Control Board for approval. **Comment:**	K. Griffin	3/15/96
8.	**Task:** Implement the Programmatic Structure Maintenance Plan. **Deliverable:** Approval notification of BCP. **Comment:**	L. McGovern	funding plus 30 days

ROCKY FLATS FIELD OFFICE

ROOT CAUSE ANALYSIS REPORT

[Kathene Issue in Building 776]

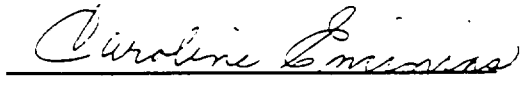
Prepared by

STANDARDS, PERFORMANCE & ASSURANCE

Team Lead

ED WESTBROOK 

Team Members

Caroline Encinias 

Lam Xuan 

Ed Ater (SAIC) 

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ROOT CAUSE ANALYSIS REPORT
Revision 1, September 1, 1995

[Kathene Issue in Building 776]

Section:

- ATTACHMENTS:

[1] Sitewide Commitments Management Program and Integrated Work Control Program

ROOT CAUSE ANALYSIS REPORT

[Kathene Issue in Building 776]

1. PURPOSE

Standards, Performance and Assurance (SPA) was assigned the task of performing a "root cause analysis" pertaining to the degradation of the load bearing floor in Building 776 (i.e., DNFSB kathene issue).

2. SCOPE

The analysis was designed to determine what sequence of events and causal factors allowed the potential structural integrity/kathene issue in Building 776 to go unreported to the Office of the Manager.

3. APPROACH

The overall approach taken was to gather information, construct the sequence of events, analyze the events to identify erroneous actions, inappropriate inactions, and investigate why errors and inactions occurred. Specific focus was placed upon examining the flow of information up the chains of command (within RFFO and the Contractor organizations) and the information flow between the contractor and RFFO.

3.1 Data Collection and Chronology of Events

The data collection effort was aimed at answering, to the greatest degree possible, the following questions:

- When did information regarding the situation become available?
- Specifically, what was the available information?
- To whom was the information made available?
- What actions were taken in response to the information (i.e. reporting, corrective actions, etc.)?

Interviews were conducted with sixteen (16) RFFO employees and five (5) contractor employees. The RFFO interviewees were from the following organizations: Facility and Material Stabilization; Environment, Safety and Health; Site Support and Security, Project Management and Engineering; Training and Development; and the Office of the Manager. Contractor personnel interviewed were from Building 776 Operations, Technical Support , and Engineering.

Interviewees provided a substantial amount of documentation, ranging from internal correspondence to maintenance work packages, which constituted the primary objective evidence used by the team. Interviewee comments not supported by documentation or other interviewees were disregarded.

The Chronology of Events was developed from the objective evidence obtained by the team and is included as Attachment 1 to this report. It is clear from this chronology that knowledge of the situation was available for approximately one and one-half years prior to RFFO receiving formal notification of a structural problem. In addition, the chronology shows that RFFO was formally notified nearly five months prior to the Defense Nuclear Facility Safety Board (DNFSB) staff's tour of the building.

3.2 Analysis

The analysis phase utilized the Events and Causal Factor Analysis techniques defined in DOE-NE-STD-1004-92, *Root Cause Analysis Guidance Document*, and the Direct Derivation method. The sequence of events were plotted along a time line, and segregated according to whom the event was directed (i.e. contractor, DOE, or DNFSB). Points were identified on the timeline where certain actions should have occurred but did not, such as the preparation of an Occurrence Report in accordance with DOE Order 5000.3B. The timeline displays clear points of opportunity for both DOE and the contractor to raise questions regarding the significance of the situation in building 776/777.

The second portion of the analysis phase involved determining why actions that should have occurred did not. This involved analyzing the use of existing Site programs such as the:

- Integrated Work Control Program (IWCP)
- Plant Action Tracking System (PATS)
- Sitewide Commitments Management Program (SCMP)
- Occurrence Reporting and Processing System (ORPS)
- Unresolved Safety Question Determination (USQD)
- Nonconformance Reports (NCR)

The team reviewed procedures and documentation relative to the Kathene problem to determine whether the cited programs were used, and if so, whether they were used in the appropriate and correct manner. In addition, the team also performed additional interviews to identify the specific training provided to RFFO personnel who had potential knowledge of the situation. The team sought to determine whether or not RFFO personnel had sufficient knowledge of:

- plant programs and their proper usage
- structural problems and their implications in nuclear facilities.

Attachments 1 through 4 were designed to demonstrate the relationship between events, programs, and the impact on the reporting of the issue.

3.3 Inform

The B-776 Root Cause Analysis Report identifies the one (most) direct cause and root cause related to the kathene / structural issue in Building 776.

The "root cause" is the actual stopping point in the assessment of causal factors. It is the place where, with appropriate inter-action, the information will be used as a baseline for corrective action, process improvement and lessons learned.

4. CONTRIBUTING FACTORS

A. Building 776 personnel lacked the knowledge base pertaining to the nuclear facility authorization basis.

Building management did not recognize the technical and structural significance of the ceiling degradation. The use of safety pre-screen, Safety Evaluation Screen (SES) and Unresolved Safety Question Determination (USQD) processes could have potentially provided the link for upgrading the deficiency (*i.e., missed opportunities*).

Proper safety / issue screening and development of an action plan that addressed the actual nuclear facility structural deficiency (i.e., based on the "safety significance, load bearing capacity or occupancy hazard) would have potentially increased RFFO management awareness of the problem. The actual floor deterioration engineering "evaluation" failed to link safety implications/ramifications, structural integrity issues and the facility authorization basis to facilitate significance awareness and reporting by building management

B. Failure of building management to issue an Occurrence Report.

RFFO and contractor personnel did not believe and occurrence report was necessary. It was also stated by more than one interviewee that an occurrence report was not required since the situation was already entered into the IWCP for correction and was being tracked in the PATS (as a RCRA deficiency).

The Occurrence Report was prepared only when the "floor" in B-776 became a DNFSB issue. It should be noted that the initial Occurrence Report failed to capture the significance of the underlying "occupancy hazard".

C. The lack of interorganizational communication within RFFO with respect to the kathene issue in B-776.

Line management possessed knowledge of the RCRA related ceiling deficiency in 1994. In addition, formal notification of structural damage was provided to RFFO line management in January 1995. This information was not communicated to support organizations (engineering, safety and maintenance) that could have provided the technical expertise for assessing the structural and safety significance.

The current system contains no written guidance defining what information must be reported to the Manager.

D. The SCMP Procedure, PO4-SCMP-16.00, does not provide for the integration of deficiency reporting systems or changes in concern significance.

Engineering "deficiency reports" (i.e. work control forms) were prepared for the kathene issue in building 776, but were not captured by the SCMP (which utilizes PATS). This resulted in a disconnect between the actions plans, occurrence report with respect to the structural deficiency. In addition, the action plan in PATS was revised three times with no change to the categorization (i.e. high, medium, or low).

5. DIRECT CAUSE

RFFO personnel did not pursue a line of inquiry necessary to identify and report the significance of the structural damage in B776/777 as a result of historical Kathene leakage. Throughout the process, the required level of "technical inquisitiveness" was not demonstrated. "RFFO failed to pull the string!"

RFFO personnel were aware of the situation in the context of a "RCRA deficiency". That is how the situation was originally identified by the contractor, and how it continued to be identified in the PATS despite the realization by the contractor that the problem was more significant. When RFFO received formal notification of the structural problem it focused its questions on the corrective actions being taken. The contractor had a corrective action plan developed, it was being tracked in the PATS, and sufficient funding was stated to be available to complete the necessary repairs.

Contractor personnel expressed a belief that until destructive tests were completed there was no way to verify the claim of structural damage to the facility. RFFO did not sufficiently challenge the contractor's position.

6. ROOT CAUSE

RFFO personnel did not comprehend or recognize the potential significance of the structural problem.

RFFO personnel aware of the situation were not well versed in the area of structural engineering. In addition, there was a failure to recognize the relationship of a structural problem to the facility authorization basis. The failure to perceive the significance of the situation (a structural problem in a nuclear facility) coupled with a focus on RCRA compliance and corrective measures precluded notification to the RFFO Manager.

Attachment 1

CHRONOLOGY of EVENTS

[Kathene Issue in Building 776]

DATE	TYPE OF CORRESPONDENCE	COMMENTS
	Kathene Spill	
	Identified as a RCRA Deficiency	
07/08/93	Work Control Form Work Control Number: TB069040 Building 777, L-14 Col. 1st Floor Ceiling to Room 430 shows damage resulting from past Kathene and/or water leaks. Ceilings must be in good condition to comply with RCRA Permit.	Recommendation: Support Ceiling Per Structural Engineering Guidance.
	Facility Representative Aware of Problem	
08/03/93	Memorandum To Systems Engineering From Architectural Engineering Subject: Strip/Seal/Paint Ceiling Area Building 776/777 HLS-048-93 An additional step has been inserted allowing structural engineering to do an inspection after cleaning the damaged areas.	This memo supersedes memo HLS-043-93 issued 7/14/93
02/10/94	Corrective Action Plan Commitment #: 94-000273, Revision: 0 Various locations in Buildings 776 & 777 Repair the ceiling in Buildings 776 & 777, in specific areas where deteriorated.	See Attachment # 2
02/10/94	Corrective Action Plan Commitment #: 94-000273, Revision: 1 Various locations in Buildings 776 & 777 Repair the ceiling in Buildings 776 & 777 in specific areas where deteriorated.	See Attachment # 2

DATE	TYPE OF CORRESPONDENCE	COMMENTS
10/12/94	Memorandum To Facility Manager, B776 From Waste Reduction Engineering Subject: Building 776/777 Kathene Damage on the Second Floor-CPC-048-94 To provide preliminary Engineering assessment of potential damage due to Kathene leaks on the second floor.	It appears that some concrete damage has occurred. The concrete is deformed and the metal pan on the underside of the concrete has rusted thru. The reinforcing bar in the concrete may also have corroded and possibly damaged the structural integrity of the second floor in this area.
11/01/94	Memorandum To Facility Manager, Building 776, From Waste Reduction Engineering, T130I Subject: Non-Destructive Testing Second Floor In Building 776 For Possible Concrete Damage, CPC-052-94	To provide Building Operations with Engineering's recommendation to obtain an NDT contractor (Olson Engineering) to determine structural integrity of the concrete.
11/03/94	Corrective Action Plan Commitment #: 94-000273, Revision: 2 Various locations in Buildings 776 & 777 Repair the ceiling in Buildings 776 & 777 in specific areas where deteriorated.	See Attachment # 2
11/03/94	Associate Deputy for EM-30, DM and AMOWM Toured Building 776 No Mention of Structural Problem	
12/13/94	ABC and RFFO Manager Toured B776 No Mention of Structural Problem	
12/22/94	Letter to AM, Operations and Waste Management, DOE/RFFO, From Director, Waste Management, EG&G, Subject: Compliance With The Mixed Residue Permit - TGH-497-94	Stated that repair of the ceiling in B776/777 will not be complete.

DATE	TYPE OF CORRESPONDENCE	COMMENTS
01/06/95	Non-Destructive Testing Investigation Floor Slab Integrity Evaluation Second Floor, Building 776 Prepared by Olson Engineering	
01/16/95	Memorandum To B776/777 Facility From Civil/Structural Engineering, B130, and Waste Storage & Disposal Engineering, T130I Subject: Structural Evaluation Of Damaged Concrete Ceiling In Residue Storage Areas of Building 776/777 - STK-004-95	Considerable degradation of the concrete exists on the surface and underside of the elevated second floor slab due to the highly corrosive effects of Kathene. A steel angle base support for the Kathene unit in the vicinity demonstrated severe degradation. The re-bar is also degraded thereby performing at a reduced capacity.
01/24/95	Engineering Order Type III GES Engineering Design Package Project/WCF Number: TB069040 Buildings 776/777 Strip/Seal/Paint Ceiling Areas	
01/24/95	Work Control Form Work Control Number: TOO81046 Repaint Ceiling Surfaces in Rooms 131, 134, 154, 127 and 430, B776 Ceilings to be in good condition to comply with RCRA Permit.	Recommendation: Repaint Rusted/ Deteriorating Areas
01/25/95	Letter To AM, Operations and Waste Management, DOE/RFFO, From Waste Reduction and Assay Building 776 Subject: Ceiling Deterioration in Building 776/777 - WAF-012-95 Updates the status of the ceiling deterioration. Completed compensatory measures required to protect regulated drums, obtained a structural evaluation, and identified corrective measures.	Structural evaluation indicates one area in Room 430 of 777 has sustained structural damage.

DATE	TYPE OF CORRESPONDENCE	COMMENTS
	RFFO Aware of Problem Based on Communications with the Contractor Satisfied with the Contractor's Actions: --Corrective Action Plan Developed And Being Tracked in PATS; --Engineering (Contractor) Involved And Corrective Action Being Pursued; --Funding Available to Correct Problem.	
02/01/95	Memorandum To 776/777 Facility From Civil/Structural Engineer, B130, and Waste Storage and Disposal Engineering, T130I Subject: Updated Structural Evaluation of Damaged Concrete Ceiling In Residue Storage Areas Of Building 777 - STK-007-95	Communicates the same structural evaluation of 01-16-95. Proposed remedial actions are being implemented within the bounds of WCF #TB-069040. Authorized personnel may access the area with protective "Hard Hats."
02/14/95	Memorandum To Building 776/777 Environmental Coordinator From Building 776/777 Waste Reduction Assay Engineering Subject: Damaged Concrete Ceiling Due To Leaking Kathene From Kathabar Leaking In The Past.	Olson Engineering performed NDT on the L-14 area and submitted a report confirming bad concrete. Work Order #T0081046 addresses stripping, sealing and painting. Work Order #TB069040 addresses installing support under concrete slab.
02/14/95	Corrective Action Plan Commitment #: 94-000273, Revision: 3 Various locations in Buildings 776 & 777 Repair the ceiling in affected areas of Buildings 776 and 777.	See Attachment # 2
05/11/95	Work Control Form Work Control Number: TOO83150 Building 776, Room 154 Concrete ceiling above Room 154 is damaged from past kathene leaks from kathabar system on 2nd floor.	Recommendation: Install structural steel shoring on the under side of the 2nd floor above Room 154 at column line K-2W

DATE	TYPE OF CORRESPONDENCE	COMMENTS
05/25/95	Engineering Order GES Engineering Design Package Project/WCF Number: TOO83150 Building 776, Room 154, Shore ceiling Install structural support above Room 154 on concrete ceiling.	
06/14/95	Work Control Form Work Control Number: TOO83628 Concrete Ceiling Above Room 127 Is Damaged From Past Kathene Leaks From The Kathabar System On The Second Floor, Building 776	Recommendation: Install structural steel shoring on the underside of the 2nd floor above Room 137 at Column K8
06/21--22/95	Defense Nuclear Facilities Safety Board Walkthrough of Building 776/777	
06/28/95	Memorandum To Distribution From Engineering and Safety Services, B130, Subject: Draft Action Plan For Deteriorated Concrete in Building 776 - DPS-079-95	Distribution: Caimi, Franz, Jr., Gilmour, Jr., Kell, Saunders, and Zimmerman Three separate repair packages have been issued. The repair is essentially a corrugated metal and beam subfloor system to support the localized areas of deterioration. The repair does not return the slab to its original design capacity.
07/03/95	Memorandum To VP, Special Material Management and Integration, Kaiser-Hill and Facility Manager 776/777 and 779, Subject: Kathene Issue in Building 776 Safe Sites of Colorado	Transmits RFFO & DNFSB Staff questions/concerns regarding the Kathene issue in B776/777.

DATE	TYPE OF CORRESPONDENCE	COMMENTS
07/10/95	OCCURRENCE REPORT (Rev. 0) # RFO--KHLL--SOLIDWST-1995-0001 Ceilings Degraded Buildings 776/777, Rooms 127, 154, 430 & 134	Evaluation: N/A
07/12/95	Letter to AM, Operations and Waste Management, DOE/RFFO From VP, Special Material Management and Integration, Kaiser-Hill Subject: Kathene Issue in Building 776	Consolidated response to questions submitted by RFFO and the DNFSB.
07/15/95	SHIFT ORDER NUMBER 776-95-01 Revision Number 7 Barricaded Egress on First Floor of Building 776/777 Under and Around the Kathabar Units on the Second Floor. Prevents Access to all Kathabar Units. Hard Hats and a Radio are required.	
07/25/95	OCCURRENCE REPORT (Rev. 1) #RFO--KHLL--SOLIDWST-1995-0001 Ceilings Degraded Buildings 776/777, Rooms 127, 154, 430 & 134	Evaluation: The condition of the structural slab warrants more detailed and intensive investigation for final disposition of the issue.
08/03/95	Letter to Thomas Grumbly From Defense Nuclear Facilities Safety Board, Concerning the Structural Integrity of Buildings 771 and 776/777 at Rocky Flats	Provides observations developed by the DNFSB and an outside expert. The Board requests that DOE provide a report within 60 days.
08/03/95	Action Item to RFFO and Kaiser-Hill Subject: DNFSB Letter on Structural Integrity Issues	Advises of the letter to Thomas Grumbly and provides the questions requiring a response. Also includes letter to AM, FAMS, from Kaiser-Hill providing Background, Summary and Conclusions, Discussion and the Plan of Action.

Attachment 2

Contributing Factor Worksheet

[Kathene Issue in Building 776]

INFORMAL REPORTING	Impact on RFFO Reporting
Kathene Damage B-776 2nd Floor • Memo (CPC-048-94) 10/12/94 - obvious concrete damage • Memo (STK-004-95) 1/16/95 -proposed remediation suggested • Memo (STK-007-95) 1/16/95 -repairs L/A/W WCF #TB-069040	• Did not provide a "cross-walk" to the formal reporting system (s) (Occurrence Reporting, Sitewide Commitments Management Program - SCMP or Non-Conformance Report - NCR [3]) • Failed to up-grade the "safety" significance classification of the kathene related deficiency (i.e. occupancy hazard)
FORMAL REPORTING	Impact on RFFO Reporting
RCRA Deficiency B-776 • SCMP Corrective Action Plan (94-000273) Rev. 0 - Rev. 3 • Work Control Forms (WCF's) • Occurrence Report [1] (ORP's) • Occurrence Report (Rev. 1) [2]	• Failed to capture the "safety significance" of the structural deficiency for a nuclear facility (i.e. occupancy hazard) • Memo's & WCF's were used to report and control the "ceiling" repairs without using the SCMP "action plan" process • ORP's did not address the authorization basis, USQ, or occupancy hazard potential. • Did not reference or include the more "safety" significant items reported in the "internal" contractor memo(s) • Reporting focused on RCRA compliance as opposed to a nuclear facility structural deficiency

[1] The contractor generated the Occurrence Report after it became a DNFSB concern.
[2] The contractor revised the Occurrence Report and indicated that the condition of the structural slab warrants a more detailed and intensive investigation.
[3] NCR's are used for reporting Vital Safety System deficiencies only

Attachment 3

Corrective Action Plan Matrix (94-000273)

[Kathene Issue in Building 776]

TASK 1	TASK 2	TASK 3	TASK 4	Managers
Rev. 0 (2/10/94) Place IWCP No. TB 069040, "Repair the ceiling in building 776/777, where deteriorated", in the Maintenance Action Center (MAC).	Provide a scheduled completion date for IWCP "Repair the ceiling in building 776/777, where deteriorated", based on the MAC schedule.	Revise action plan for IWCP No. TB 069040 to reflect completion date	Complete the work scope of IWCP No. TB 069040, "Repair the ceiling in building 776/777, where deteriorated.	J. M. Bower M. R. Parker M. R. Greene
Rev. 1 (2/10/94) Place IWCP No. TB 069040, "Repair the ceiling in building 776/777, where deteriorated", in the Maintenance Action Center (MAC).	Provide a scheduled completion date for IWCP "Repair the ceiling in building 776/777, where deteriorated", based on the MAC schedule.	Revise action plan for IWCP No. TB 069040 to reflect completion date	Complete the work scope of IWCP No. TB 069040, "Repair the ceiling in building 776/777, where deteriorated.	J. M. Bower M. R. Parker M. R. Greene
Rev. 2 (11/03/94) mplete the work pe of IWCP No. TB 069040, "Repair the ceiling in building 776/777, where deteriorated".	N / A	N / A	N / A	A. A. Dye J. M. Swartz
Rev. 3 (2/14/95) Complete job planning to provide an estimate of costs.	Submit change control action to request EM 30 funds since it is a compliance action.	Install a metal plate over entrance to Area 2 in RM 430 where the corrosion is most severe and support the plate to I-beams.	Scrape and paint remaining areas where corrosion exists. This includes Rooms 154, 134, 127, and 430.	W. A. Franz J. M. Swartz

Scope of Work

This action plan addresses the steps necessary to assure the condition of the containment building (Bldg. 776/777) for regulated units is adequate to meet permit conditions set forth in the Part B Modification to the State RCRA Permit. The steps necessary to complete the corrective action are addressed in IWCPs related to completion of corrective actions.

Attachment 4

SCMP/IWCP

Contributing Factor Worksheet

[Kathene Issue in Building 776]

IWCP/WCF REPORTING [3]	Impact on Reporting Issue
Kathene Damage B-776 2nd Floor • Engineering Orders • Work Control Forms (i.e., Deficiency Report) - T0083150 - T0081046 - T0083628 - TB069040 • Engineering "Action Plan" (Ref. DPS-080-95 MEMO - Snyder to Franz 6-29-95)	• Failed to communicate the safety significance of the concrete degradation in relation to the nuclear facility authorization basis (i.e., USQD). • Did not provide a "link" for updating the formal Action Plan in Sitewide Commitments Management Program (SCMP). • Failed to identify and transfer the safety significance or mitigation of potential occupancy hazards to SCMP (e.g., Shift Order 776-95-01) • Did not provide a link to upgrade the deficiency status (i.e., structural deficiency vs RCRA violation)
SCMP/ORPS REPORTING [4]	Impact on Reporting Issue
RCRA Deficiency B-776 • SCMP Corrective Action Plan (94-000273) Rev. 0 - Rev. 3 • Occurrence Report [1] • Occurrence Report (Rev. 1) [2]	• Did not address the potential for posing an occupancy hazard or potential impact on the "authorization basis" for a nuclear facility (i.e., USQD). • Failed to capture the safety significance and ramifications involving the integrity of B-776 floor slabs and portions of the ventilation system • Did not reference or include the more safety significant "issues" reported in the contractor's internal memo(s) • Reporting focused on RCRA compliance as opposed to a structural deficiency

[1] The contractor generated the Occurrence Report after it became a DNFSB concern.

[2] The contractor revised the Occurrence Report and indicated that the condition of the structural slab warrants a more detailed and intensive investigation.

[3] Sitewide Commitments Management Program and Work Control Form

[4] Integrated Work Control Program and Occurrence Reports

SAFETY BULLETIN-Rev. 1
September 26, 1995

ISSUE

The Rocky Flats Environmental Technology Site (RFETS) has observed potential structural degradation in its Pu processing facilities due to previous leaks and spills of aqueous Lithium Chloride. As a result of this potential structural degradation, RFETS has declared a potential Unreviewed Safety Question (USQ). We are currently in the process of investigating the magnitude of this issue across the site.

BACKGROUND

Aqueous Lithium Chloride (hereafter referred to as LiCl), was used as an air drying agent in air drying units from the mid 1960's through 1990 in three Pu processing facilities at RFETS, specifically Buildings 707, 776/777, and 779. We are assessing the effects of LiCl as part of our continuing investigation of the structural integrity of the aforementioned buildings. LiCl is neutral in water and is a salt of hydrochloric acid (HCl). The actual pH could be slightly more acidic or basic depending on the contaminates in the air. HCl is neither added to LiCl nor produced as a by-product of the air drying process. LiCl is very soluble and exhibits ionization (Li+, Cl-) when put in water. Solutions as high as 30-40 wt% were used in the air drying process.

The corrosion found at RFETS was initiated when the LiCl spills diffused into the concrete floor slabs and chlorine ions came in contact with the reinforcing steel. Typically, in reinforced concrete, there is a passive oxide film on the surface of the reinforcement steel which prevents corrosion. The chloride ions in LiCl have the ability to destroy this protective film. The ensuing reinforcement steel corrosion causes expansion and eventually leads to delamination of the adjacent concrete. Final visual evidence of damage may appear in the form of surface spalling. The amount of chloride required to initiate corrosion depends on the pH of the solution in contact with the steel. Comparatively small quantities are needed to offset the alkalinity of Portland Cement. It has similar properties as road salt and is hygroscopic in nature (see attached MSDS sheet).

DISCUSSION

RFETS has observed that spills of LiCl onto concrete flooring around air drying units because of system malfunction and/or operator problems have degraded the concrete and the reinforcement (i.e. rebar). RFETS has observed concrete degradation that appears to emanate from the areas of LiCl spills. We have visually observed delamination of the concrete and corrosion of some areas of the concrete pour-pan on the underside of the second floor slab in Building 776/777.

We have also observed that concrete core samples taken from around the air drying units in Building 776/777 appear to have internal fractures representative of imbedded rebar corrosion. The pH of these samples ranges from 9.7 to 12.1. Not all of the degradation is visible, as painting over and patching of concrete on the top of the slab as well as presence of a painted pour-pan on the underside of the slab tend to mask this problem.

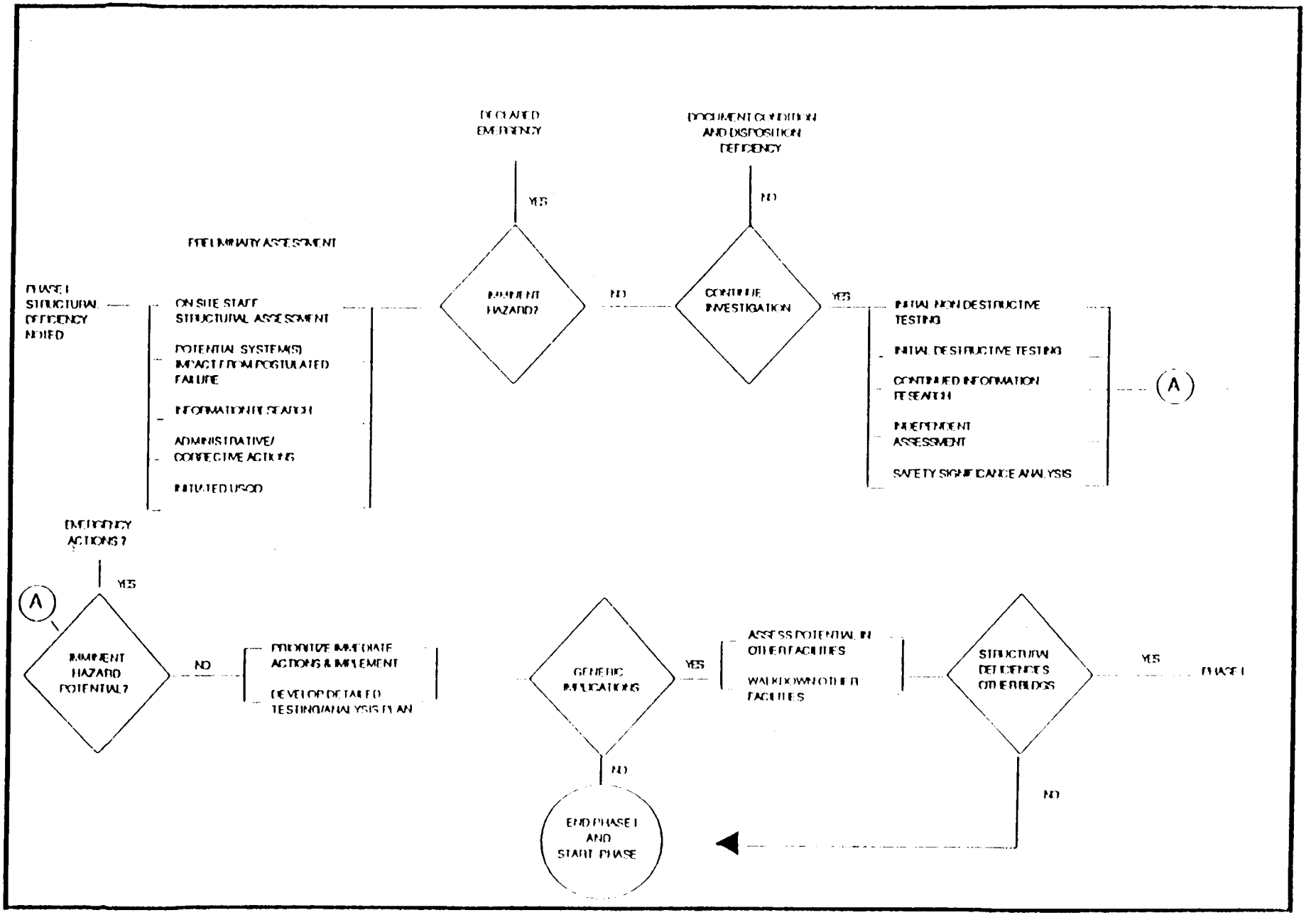
These air drying units are located on the second floor of the buildings in question. RFETS has taken steps to limit access in the immediate vicinity of the air drying units. In addition, administrative controls have been placed to restrict floor loading of and restrict access below degraded areas. Continuing analysis and compensatory actions are being implemented. For example, RFETS is proceeding to structurally reinforce the worst affected areas in Building 776/777 as well as confirming the role of LiCl and its mechanism of attack on the structure. Plans are also targeted at examining the generic implications of chemical spills on other on-site facilities. Finally, programmatic features will be reviewed to ensure that root cause(s) are identified and that the appropriate processes are in place to preclude similar circumstances from happening in the future.

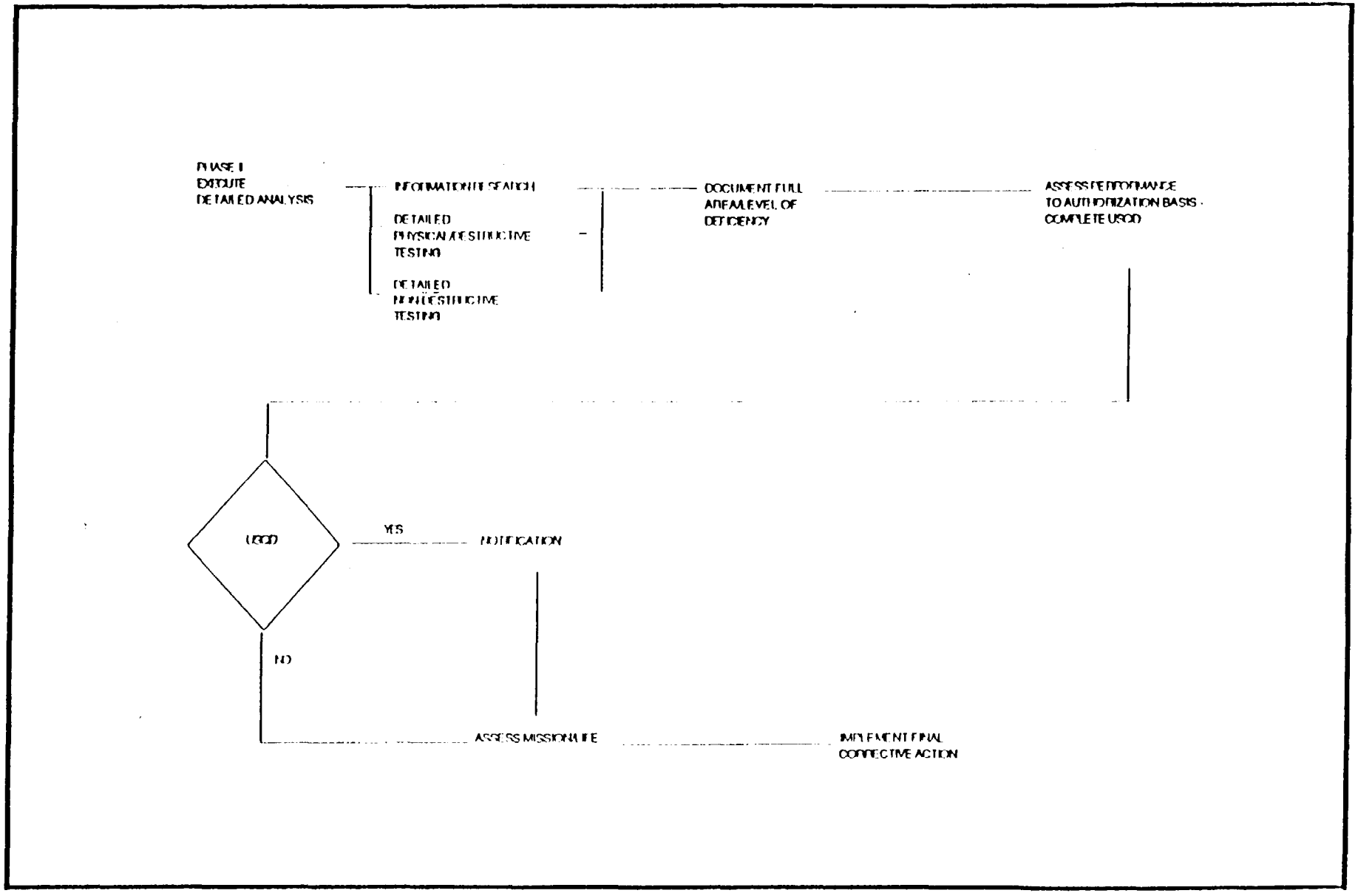
It appears that the degradation process is slow to develop. It takes time to depress the pH of the concrete slab, more time to decompose the protective oxide film, and then more time still to corrode the reinforcement steel which subsequently results in concrete delamination. While the slabs in Building 776/777 are not in danger of imminent collapse, initiating events such as severe mechanical vibrations (i.e. major ventilation fan imbalance) or high winds require us to resolve this issue as expeditiously as possible by identifying the root cause(s) and long term corrective actions. We will keep you informed of results and findings as they become available.

QUESTIONS

If there are any questions or you need additional information, please contact Paul Golan at 303-966-2879 or James
at 303-966-7417.

INTEGRATED STRUCTURAL SCREENING LOGIC DIAGRAM




PHASE II
EXECUTE
DETAILED ANALYSIS
INFORMATION SEARCH
DETAILED
PHYSICAL/DESTRUCTIVE
TESTING
DETAILED
NON-DESTRUCTIVE
TESTING
DOCUMENT FULL
AREA LEVEL OF
DEFICIENCY
ASSESS PERFORMANCE
TO AUTHORIZATION BASIS -
COMPLETE USQD
USQD
YES
NOTIFICATION
NO
ASSESS MISSION LIFE
IMPLEMENT FINAL
CORRECTIVE ACTION