February 11, 1998

Mr. Thomas F. Plunkett
President - Nuclear Division
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: SITE VISIT TO GATHER INFORMATION ON AIR-OPERATED VALVES, TURKEY POINT UNITS 3 AND 4

Dear Mr. Plunkett:

This letter is to confirm that representatives of the Nuclear Regulatory Commission (NRC) will be visiting your Turkey Point facility during the week of March 23, 1998, to gather information on air operated valves. The NRC is gathering information to determine if the NRC needs to focus additional attention on air-operated valves. The enclosed document describes the program plan for the study of air-operated valves. The dates of the visit were determined after consultation with Olga Hanek of your staff.

If you have any questions regarding this matter, please contact me at (301) 415-1475.

Sincerely,
/s/
Richard P. Croteau, Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket Nos. 50-250 and 50-251

Enclosure: As stated

cc w/enclosure: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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cc w/enclosure: See next page

Mr. T. F. Plunkett
Florida Power and Light Company

TURKEY POINT PLANT

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Atlanta, GA 30303-3415

PROGRAM PLAN FOR THE STUDY OF AIR-OPERATED VALVE CONCERNS IN NUCLEAR POWER PLANTS

I. Purpose of the Study

A. The purpose of the study outlined in this program plan is to determine if the NRC needs to focus additional attention on the design, qualification, testing (initial and in-service), and/or maintenance of safety-related and important non-safety-related air-operated valves (AOVs), as described below, in order to reduce plant vulnerabilities associated with individual, common cause, or common mode failures.

B. If additional NRC attention regarding AOVs is found necessary, recommendations will be provided.

II. Project Information

A.	PROJECT TITLE:	Study of Air-Operated Valves
B.	JOB CODE:	E8238, Task Order No. 15
C.	NRC B&R NUMBER:	782-15-11-60-25
D.	CONTRACTOR:	Idaho National Engineering and Environmental Laboratory (INEEL)
E.	NRC PROJECT MANAGER:	E. Trager, (301)415-6350
F.	NRC TECHNICAL MONITOR:	H. Ornstein, (301)415-7574
G.	INEEL PROJECT MANAGER:	J. Bryce, (208)526-8231
H.	INEEL PRINCIPAL INVESTIGATOR:	O. Rothberg, (301)816-7773
I.	INEEL INVESTIGATOR:	M. Holbrook, (208)526-4362
J.	INEEL INVESTIGATOR:	S. T. Khericha, (208)526-9254
K.	INEEL INVESTIGATOR:	J. Watkins, (208)526-0567

III. Background

A. Operating experience (recent AOV failures and recently discovered AOV design deficiencies) indicates that the Nuclear Regulatory Commission (NRC) may need to focus additional attention on the design, operation, testing (qualification and in-service), and maintenance of AOVs in order to reduce plant vulnerabilities associated with individual or common-mode AOV failure. Although degradation, malfunction, or failure of a particular AOV may not be safety significant, there is concern regarding common cause or common mode AOV failures that could affect multiple safety systems as well as multiple trains of redundant safety systems.

B. AOVs are used in all U. S. nuclear power plants (NPPs). The number of AOVs per plant varies widely and the number of safety-related AOVs per plant varies from several to many hundreds. Boiling water reactors (BWRs) usually have more AOVs than pressurized water reactors (PWRs) because AOVs are used extensively in BWR scram systems. Excluding the BWR scram system, older

Enclosure

plants generally have more safety-related AOVs than do newer plants. Many plants have large numbers of AOVs that are not necessarily designated as safety-related but whose failure might affect safety are also included.

C. AOVs are actually systems composed of several subsystems which include the valve body, actuator, and control system. In NUREG/CR-6016, the NRC staff produced an analysis of more than 1500 safety-related AOV failures [Nuclear Plant Reliability Data System (NPRDS) data covering the period 1988 through 1990]. That study showed that:

1. 42 percent of the failures were attributed to the control subsystem (includes sensors, controllers, solenoid-operated valves (SOVs), positioners, pressure regulators, filters, and supply air);
2. 36 percent of the failures were attributed to the actuator subsystem (includes diaphragms, springs, bonnets, yokes, pistons, cylinders, stems);
3. 19 percent of the failures were attributed to the main valve (includes the pressure-retaining component which directs or controls the fluid of interest);
4. subsystem components that were the dominant contributors to AOV failures included SOVs, diaphragms, seals, trim, and air lines.

D. AEOD issued two case studies, NUREG-1275, Volume 2 on air systems problems and NUREG-1275, Volume 6 on SOV problems. Although those studies were not focused on AOVs, they contained relevant information on two of the dominant contributors to AOV failures. These NRC Office for Analysis and Evaluation of Operational Data (AEOD) studies on air systems and SOVs provide examples illustrating plant vulnerability to common mode and common cause failures (CCFs).

E. The NRC issued over six dozen generic communications addressing AOVs and their associated subsystems including SOVs and air systems. The NRC issued generic letters to alert licensees and describe corrective actions to minimize the risk from instrument air systems (Generic Letter 88-14) and SOVs (Generic Letter 91-15).

F. The industry took a wide range of actions to address these issues since the generic letters were sent. Some plants instituted aggressive programs to upgrade their air systems and implement extensive SOV design verification, maintenance, and testing improvements. Many utilities implemented AOV diagnostics programs that utilize recently available AOV diagnostic equipment. In contrast, some utilities have taken a minimal approach to AOV and air system improvements. It should be noted that there are no NRC requests outstanding (such as those in Generic Letter 89-10 and its supplements regarding motor-operated valves) for diagnostic testing of safety-related AOVs.

IV. Objectives

A. Evaluate recent (last 12 years) AOV operating experience with emphasis on the most recent and most significant events in order to help the NRC draw conclusions about the effectiveness of NRC regulations and industry actions regarding AOV design, qualification, operation, maintenance, and testing.

1. Safety-related AOVs and important non-safety-related AOVs (see the discussion of equipment to be considered in the study, below) are to be included.

B. Evaluate the safety significance of the AOV operating experience.

C. Summarize and assess the relevant regulatory requirements that apply to AOVs.

D. Summarize and assess the relevant industry requirements that apply to AOVs.

E. Summarize and assess the relevant design basis requirements that apply to AOVs.

F. Assess the adequacy and effectiveness of AOV testing (initial and in-service) to demonstrate AOV capabilities to perform under postulated accident conditions.

G. Assess the adequacy and effectiveness of plant preventative maintenance and corrective maintenance practices, and compare such practices with AOV manufacturer's recommendations.

H. The focus of the study will be with the root causes that prevent the AOV from performing its intended function within its assigned mission time. Problems associated with the air or inert gas supply and other operating parts or mechanisms, such as controllers, positioners, boosters, regulators, springs, gaskets, diaphragms, solenoids, or the valve, will be of interest if such component or equipment problems, related to the air (pneumatic) operator's function, cause degradation or failure of the AOV to perform its function within its designated time restraints.

1. For example, a manual valve in an air supply line might not be of interest in this study unless some cause of failure or potential failure of the valve had an effect on the air system and thus had potential or actual effects on AOVs that use the supply line as a source of operating fluid. However, a solenoid operator that controls an air pilot valve that is a part of a valve operator would usually be of interest.

V. Equipment To Be Considered

A. Air-operated valves (AOVs):

1. AOVs are defined as valves which use air or inert gas as the motive power

source to change the position of valve, valve operator, or a component of the valve.

a. Other parts or mechanisms such as springs, diaphragms, transducers, plungers, or solenoids may be part of the operator as well.

2. Pneumatic controllers, positioners, boosters, and regulators will also be considered to be within the definition of "air operators" (or, at least, part of the operating system) for AOVs for the purposes of this study.

B. AOV operating and support systems and components:

1. Air or inert gas supply system and components,

a. The air or inert gas operating fluid might be supplied from the plant's pneumatic systems such as instrument air/service air system(s), accumulators, or receivers, or from the process fluid.

2. Electrical supply system and components that serve the AOV directly.

C. The following safety-related and non-safety-related AOVs and AOV support systems are included in this study:

1. Safety-related AOVs and AOV support systems that are relied upon to:
   a. remain functional during and following design basis events,
   b. ensure the integrity of the reactor coolant pressure boundary,
   c. ensure the capability to shut down the reactor and maintain it in a safe-shutdown condition, and
   d. ensure the capability to prevent or mitigate the consequences of accidents the could result in potential offsite exposure comparable to the 10 CFR 100 guidelines.

2. Non-safety-related AOVs and AOV support systems:
   a. that are relied upon to mitigate accidents or transients,
   b. that are used in plant emergency operating procedures,
   c. whose failure could prevent safety-related structures, systems, and components (SSCs) from fulfilling their safety-related functions, or
   d. whose failure could cause a reactor scram (trip) or actuation of a safety-related system.

3. the safety-related and non-safety-related AOVs described above should perform their intended function under design-basis conditions, as well as normal operating conditions.

D. Information may be collected and analyzed concerning other non-safety-related AOVs if it appears that information about those components may be pertinent to the study of AOVs and AOV support systems included in the above categories.

VI. Project Overview

A. Task 1 - Develop Program Plan.

B. Task 2 - Collect data and review literature.

C. Task 3 - Perform an analysis of events identified from the collected data and literature review.

D. Task 4 - Visit 7 sites and collect data in parallel with, and to supplement Task 3.

E. Task 5 - Perform risk assessments to characterize and rank significance of failures.

F. Task 6 - Prepare draft and final reports.

G. Submit progress reports and respond to TM comments throughout the progress of this study, as described in the INEEL Cost Estimate, Schedule, and Spending Plan dated July 17, 1997 for Task Order 15 of NRC Job Code E8232.

VII. Task 1 - Develop Program Plan

A. This program plan provides a detailed outline for the study of AOV performance in nuclear power plants.

B. This program plan is based on the Statement of Work (Letter from C. Rossi, NRC to J. Wilcynski, DOE/ID dated July 29, 1997) for Task Order 15 of NRC Job Code E8238, "Investigation of Air-Operated Valves."

C. INEEL resources will be allocated to Task Order 15 as described in the INEEL Cost Estimate, Schedule, and Spending Plan dated July 17, 1997. Level-of-effort information that follows was reproduced from that plan.

D. The estimated total INEEL level-of-effort on this project is 66 staff-weeks in FY-97 and FY-98. The level-of-effort for each Task is estimated to be as follows:

Task No.	Level of Effort (Staff-Weeks)
1	3
2	11
3	14
4	13
5	14
6.1	7
6.2	4
Total	66

E. The schedule presented in the Statement of Work was based on a start date of 7/28/97. However, the actual start date was 8/1/97. Accordingly, the schedule should be as follows:

TASK./Node No.	TASK TITLE	EST. COMPL. DATE
1 / 15-1	Develop Program Plan	9/4/97
none / 15-2	PROGRAM REVIEW POINT 1	10/23/97
2 / 15-3	Perform Literature Review and Collect Data	12/4/97
none / 15-4	PROGRAM REVIEW POINT 2	12/5/97
3 / 15-5	Perform Analysis of Events	3/26/98
4 / 15-6	Perform Site Visits	2/19/98
none / 15-7	PROGRAM REVIEW POINT 3	2/6/98
5 / 15-8	Perform Risk Assessments	2/19/98
6.1 / 15-9	Prepare Draft Report	5/28/98
6.2 / 15-10	Prepare Final Report	7/1/98

F. This program plan will be submitted to the NRC technical monitor for approval concurrent with commencement of Task 2.

VIII. Task 2 - Collect Data and Review Literature

A. Failures, degraded conditions, or precursor events involving AOVs that degraded plant safety margins, or that affected or could have affected safe plant operations are to be identified.

1. Review recent events in nuclear plants to identify events comparable or similar to those described in (but not limited to) the following publications:
   a. NUREG-1275, Vol. 2, "Operating Experience Feedback Report - Air Systems Problems"
   b. NUREG-1275, Vol. 6, "Operating Experience Feedback Report - Solenoid-Operated Valve Problems"
   c. NUREG/CR-6016 (ORNL-6748), "Aging and Service Wear of Air-Operated Valves Used in Safety-Related Systems in Nuclear Power Plants"
   d. Nuclear Safety Analysis Center NASC/128, "Pneumatic Systems and Nuclear Plant Safety," EPRI, Pickard, Lowe and Garrick, Inc., 10/88

2. Review recent events in (but not limited to) the following systems:
   a. Shutdown cooling system,
   b. Auxiliary feedwater system,
   c. BWR scram systems,
   d. Power-operated relief valves,
   e. Low temperature overpressure protection (LTOP) system,
   f. Service water system,
   g. Component cooling water system,
   h. Main steam isolation valves,
   i. Feedwater isolation valves,
   j. Emergency diesel generator air systems,
   k. Safety injection systems,
   l. Reactor coolant pump seal injection systems,
   m. Reactor cavity and spent fuel pool pneumatic seal systems,
   n. Other systems listed in Table 1 (page 6) of NUREG-1275, Vol. 2.

3. Identify "significant" failures or events involving:
   a. Safety-related AOVs and support systems,
   b. Other non-safety related AOVs and support systems (as defined above),
   c. Precursors or failures,
   d. Common cause or common mode failures or precursors.

B. Databases and sources to be used include (but are not limited to):

1. NRC Licensee Event Reports (LERs),
2. NRC Diagnostic Evaluation Team (DET) Reports,
3. NRC Generic Letters, Bulletins, Circulars, Notices, NUREG Reports,
4. NRC correspondence (including close-out correspondence for the above),

5. NRC Generic Issues database and resolutions,
6. NRC Inspection Reports,
7. Power Reactor Licensee reports submitted in accordance with various provisions of 10 CFR, such as 10 CFR 50.59 and 10 CFR 50.72,
8. NRC regulations,
9. NRC Sequence Code Search System (SCSS), Accident Sequence Precursor (ASP), and Common Cause Failure (CCF) databases,
10. INPO NPRDS data, publications, and correspondence,
11. EPRI Nuclear Maintenance Assistance Center (NMAC) publications,
12. Individual nuclear power plant data, publications, and correspondence (see Task 4),
13. Equipment vendor catalogs, publications, correspondence, and data,
14. American Society of Mechanical Engineers (ASME) and other, code/standards organization codes, standards, publications, or correspondence including:
    a. OM codes and standards,
    b. ASME B&PV code,
    c. ANSI and other pertinent standards,
15. Department of Energy (DOE) Occurrence Reporting and Processing System (ORPS) database,
16. DOE regulations, standards, publications, and correspondence,
17. Government Industry Data Exchange Program (GIDEP) database,
18. Available Department of Defense (DOD) data,
19. Foreign reactor experience data.

C. The components to be considered include (but are not limited to):

1. Solenoid assisted actuators,
2. Spring and diaphragm assisted actuators,
3. Piston actuators,
4. Rotary actuators,
5. Sensors,
6. Controllers,
7. Positioners,
8. Supports and attachments,
9. Attached piping and components (receivers, etc.),
10. Attached wiring,
11. Check valves,
12. Globe valves,
13. Gate valves,
14. Ball valves,
15. Butterfly valves,
16. Pilot valves or pilot operators as piece-parts of other valves.

D. Materials and component parts to be considered include (but are not limited to):

1. Diaphragms,
2. Seals,
3. Packings,
4. Elastomers,
5. Dissimilar metallic materials,
6. Process fluids and contaminants,
7. Operating fluids and contaminants,
8. Lubricants,
9. Coils,
10. Switches,
11. Seats,
12. Springs.

E. Environmental conditions to be considered include (but are not limited to):

1. Moisture or other contamination in the air supply system,
2. Aging effects including consideration of:
    a. Organic materials,
    b. Wear,
3. Temperature and heat sources,
4. Steam,
5. Radiation,
6. Wear,
7. External exposure to corrosive or caustic fluids,
8. Airborne or surface particulate contamination,
9. Electric power supply interfaces,
10. Process fluid characteristics (pressure, temperature, flow rate, viscosity, contamination, potential for water hammer effects, etc.),
11. Air or inert gas operating fluid characteristics (pressure, temperature, flow rate, viscosity, contamination, etc.),
12. Vibration and dynamic interaction with adjacent equipment,
13. Seismic load and configuration considerations,
14. Synergistic effects.

F. Review design and application procedures for AOVs.

1. Selection of AOVs for a particular service,
    a. Materials used,
    b. Valve type used.
2. Sizing methods,
    a. Study margins under operating and design basis conditions.
    b. Study how designs are verified.
        (1) Test programs and results,
        (2) Calculations and analyses.

G. Study installation procedures for AOVs.

1. In accordance with manufacturer's instructions,
2. In accordance with codes and standards,
3. Differences and potential conflicts.

H. Study operation and maintenance of AOVs.

1. Maintenance practices, such as:
   a. Predictive and preventive,
   b. PRA based.
2. Maintenance problems, such as:
   a. Frequency,
   b. Assembly and disassembly difficulties,
   c. Replacement part compatibility,
   d. Training.
3. e the similarities for comparable problems, methods of design, maintenance, and testing used for other valve operator types such as:
   a. Motor-operated,
   b. Hydraulic,
4. Defective, suspect, or counterfeit parts:
   a. Plant experience,
   b. Industry data,
   c. Govemment data.

I. Study testing procedures and equipment for AOVs.

1. Qualification,
2. In-service,
3. Diagnostic.

J. Study common mode and common cause failures and potential failures.

1. Synergistic effects

K. Make comparisons and draw conclusions, if appropriate, with industry efforts regarding other valve types such as:

1. Motor-operated valves,
2. Hydraulic-operated valves.

IX. <u>Task 3 - Perform Analyses of Events</u>

A. Construct a matrix of events and equipment, in accordance with the objectives described above, and including the following categories:

1. events affecting individual valves or operators,
2. events affecting multiple valves or operators,

3. events affecting individual trains of redundant safety-related systems or systems important to safety,
4. events affecting multiple trains of redundant safety-related systems or systems important to safety,
5. events affecting multiple safety-related systems or systems important to safety,
6. valve type or types (gate, globe, ball, butterfly, etc.,
7. operator type (piston, diaphragm, solenoid, etc.),
8. power sources (instrument air, accumulators, auxiliary electrical, auxiliary mechanical, etc.),
9. controller and control system description and characterization,
10. pertinent dates or times,
11. pertinent environmental and ambient conditions,
12. pertinent vendor or plant identifications,
13. failure mechanisms identification:
    a. root cause,
    b. common cause scenarios,
    c. common mode scenarios,
14. pertinent design, qualification, maintenance, operation, or test information,
15. safety significance.

B. Integrate and analyze data obtained from site visits with information obtained independently.
1. Identify and analyze recurring safety-related AOV failures or events not revealed elsewhere.
2. Identify and analyze recurring pertinent AOV failures or events not revealed elsewhere.

C. Identify AOV populations in plant systems and categorize (such as):
1. Plant,
2. System,
3. AOV description:
    a. Manufacturer,
    b. Type,
    c. Size,
    d. Pertinent service parameters (temperature, environment, etc.).

D. Qualitatively prioritize events involving AOVs in terms of safety significance.

1. Emphasize identification and analysis of actual and potential common mode and common cause failures.

E. Compare the data analyses and results of this task with the results described in NUREG-6016, which used the NPRDS as the data source.

X. Task 4 - Perform Site Visits

A. The following 7 (choose from list) sites will be visited in accordance with the following approximate schedule:

PLANT NAME / PROJECT MANAGER	SCHEDULED VISIT
Millstone	To Be Determined (TBD)
Diablo Canyon	TBD
Palo Verde / Kristine M. Thomas	10/28-29/97
LaSalle / Donna Skay	12/15-16/97
Palisades / Robert Schaff	11/18-19/97
Grand Gulf	TBD
North Anna	TBD
Fermi 2 / Andrew Kugler	11/3-4/97
Peach Bottom	TBD
Crystal River	TBD
Davis Besse	TBD
Turkey Point	TBD

B. The following plant-specific information is to be obtained prior to site visits, if practical. Furnish a description to the plant point-of-contact of the information in-hand and the information and data to be collected on-site.

1. Failure data,
   a. Events (LERs, Bulletins, Notices, etc. specific to this plant),
   b. Recurring failures specific to this plant (Common cause or common mode),
   c. Number and types of failures, events, or precursors,
      (1) Safety-related,
      (2) Other pertinent,

2. PRA application and data use,
   a. How are plant PRA and PRA tools used in plant, relationship to Maintenance Rule?
   b. Are predictive and preventive maintenance tasks based on PRA calculations?

3. Maintenance Data and Diagnostic systems in use,

a. Description,
b. Methods,
c. Frequency,
d. Results and description of the data collected.

4. Design data:
   a. Number of AOVs
      (1) Safety-related
      (2) Important non-safety related AOVs (as defined previously)
   b. Types of AOVs
      (1) Diaphragm, piston, etc.
      (2) Controllers, regulators, etc.
   c. Air (and/or inert gas) supply system description
      (1) Number, type, size of pumps
      (2) Supply system description
      (3) Filters, regulators, etc.
      (4) Backup and protocol
   d. Breakdown of air system service and AOV use by system
   e. Sizes of AOVs and operators in use
   f. Operating and process fluids
   g. Selection and sizing methods
      (1) Design verification including consideration of postulated transient and accident conditions.

C. Personnel to be contacted prior to each site visit should include:
   1. Headquarters, regional and on-site NRC personnel,
      a. NRC plant project manager,
      b. Cognizant NRC Region staff,
      c. NRC Resident Inspector,
   2. Plant maintenance staff representatives,
   3. Plant engineering staff representatives,
   4. Plant and utility management representatives.

D. Interview information to be obtained on-site should include:
   1. Name(s) of interviewer(s) and titles,
   2. Date(s) of visit,
   3. Plant name and docket number,
   4. Person(s) interviewed, titles, phone numbers, E-mail, addresses, etc.
   5. Describe organization and position of the person interviewed.
   6. Provide information on overall number of AOVs, air system, AOVs broken down by system, if such information was not obtained prior to the visit.
   7. Describe events involving AOVs and air systems including:
      a. Recent,
      b. Recurring,
      c. Significant (regardless of time frame).
   8. Describe AOV failures.
      a. Actual and potential,
      b. Common cause or common mode.

9. Describe actions taken after AOV events or failures.
    a. Immediate,
    b. Follow-up.
10. Describe root cause analyses.
    a. Lessons learned regarding AOVs,
    b. Unique procedures for AOVs, if any.
11. Describe maintenance and IST procedures for AOVs.
    a. Safety-related, important non-safety-related (as defined previously), other non-safety-related,
    b. What procedures, if any, are vendor approved and/or supervised?
    c. ASME and other code requirements,
    d. Describe maintenance, test, and analysis resources available.
        (1) On site, corporate, consulting, industry, etc.
12. Describe diagnostic systems used for AOVs.
    a. Description,
    b. Specifications,
    c. Data collected,
    d. Availability to plant staff,
    e. Frequency of use.
    f. Vendor approved and/or supervised
13. Describe design (and analysis) procedures for AOVs.
    a. Design bases,
    b. Vendor approved and/or supervised.
14. Describe training for installation, maintenance, and testing of AOVs.
15. Note: Emphasize to all site personnel interviewed that this is a fact-finding visit for information applicable to all plants and the information to be collected will not be used to reflect negatively on the specific plant performance. We do not intend to subject any single plant to criticism.

E. Examine design, maintenance, failure, or event records if practical.
    1. Describe maintenance, failure or event database and processes for the plant.
        a. Assessment of availability, accuracy, completeness,
        b. Obtain copies of examples if possible.

    2. Assess overall capability of plant personnel regarding AOV:
        a. design,
        b. equipment qualification,
        c. maintenance,
        d. testing,
        e. failure and events analyses.

F. View representative AOVs, if practical.
    1. In situ,
    2. In shop, storage, or test facilities.

G. Trip reports for each site visit should be prepared within two weeks of the end of each visit, if practical.

1. Trip reports should be submitted to the NRC TM.
2. Include information obtained (as described above).
3. Furnish copies to NRC PM, Region staff, Resident Inspector, and plant host as a courtesy and to seek feedback.

H. An interview form is attached to this program plan.

XI. Task 5 - Perform Risk Assessments

A. The Accident Sequence Precursor (ASP) program involves the systematic review and evaluation of operational events or conditions that have occurred at U. S. commercial light-water reactors, reported under the Licensee Event Report (LER) program. Precursors and potential severe core damage accident sequences are identified and categorized in the ASP program. The LERs generated from 1969 through 1995 have been evaluated under the ASP program and those LERs that met a screening criteria of the ASP evaluation process were further analyzed to compute conditional core damage probability (CCDP). The events which were not analyzed were considered (in accordance with the screening criteria) to be not risk significant with respect to core damage. ASP models will be used in two ways to assess AOV risk significance:

1. ASP evaluations developed over the period considered in this study will be reviewed to identify any risk significant ASP AOV and AOV support system failures that occurred in operating plants, as well as the conditional core damage probability (CCDP) associated with each of these AOV (or support system) failures.

    a. Although the simplified nature of the ASP models and reporting criteria for the LER means that many plant AOVs are not included in these models (and, thus, many AOV failures will not have been evaluated in this way), some AOV failures may have been included in these ASP analyses and will provide a useful starting point to understand the risk significance of AOV failures.

2. ASP models will be used to evaluate the CCDP of selected hypothetical AOV failures to the extent that the current leve! of model development will support such evaluation.

B. In addition to the use of ASP models, the risk significance of AOV and AOV support system failures will be evaluated by performing limited scope evaluations and sensitivity studies using completed plant SAPHIRE (Systems Analysis Programs for Hands-on Integrated Reliability Evaluations) data bases developed at the INEEL. Selected plant models will be used to evaluate the relative risk importance of AOVs in selected plant systems and the sensitivity of plant core damage frequency to changes in AOV failure rates.

1. Both independent AOV failures and common cause AOV failures will be considered.

2. To the extent practical, the current study will make use of information developed in a previous study, "GI-158: Performance of Safety Related Power Operated valves Under Operating Conditions," INEL-95/0550.

   a. Power-operated valves, including AOVs but excluding motor-operated valves were included in the GI-158 study.

   b. AOV support systems were not included in the GI-158 study.

   c. The GI-158 study described core damage frequency sensitivity in relation to changes in POV failure probability.

   d. The GI-158 study included representatives of the Westinghouse three and four loop plants as well as a GE BWR plant, for which IPE models were available in the SAPHIRE data base at the time of the study. The CE and B&W plants were not available in the SAPHIRE data base at the time, and thus were not included in the GI-158 study.

3. A representative plant will be selected for each reactor vendor and the risk significance of AOV and AOV support system failures will be calculated.

   a. Since the GI-158 study was submitted to the NRC, more IPE data has been loaded in to the SAPHIRE data base. Plants now loaded in the SAPHIRE data base now include the AP-600, CESSAR System 80+, Beaver Valley 2, Brunswick 1 and 2, Dresden 2 and 3, Fort Calhoun, Grand Gulf 1, Indian Point 2, Fitzpatrick, Farley, LaSalle 2, Oconee 3, Oyster Creek 1, Peach Bottom 2, River Bend 1, San Onofre 2 and 3, Sequoyah 1, Surry 1(NUREG/CR-1150), Zion 1, Palo Verde, Commanche Peak, and Surry-IPE.[1]

   b. For the selected plants, PRA importance measures will be calculated to learn more about both potential reductions in core damage frequency ("risk reduction importance") and potential increases in core damage frequency ("risk achievement importance") associated with AOV events identified in the IPEs.

XII. <u>Task 6 - Prepare Draft and Final Reports</u>

A. Task 6.1 - Draft Report Contents:

1. Abstract
2. Executive Summary
3. Introduction

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[1]The IPEs for Palo Verde, Commanche Peak, and Surry cannot be used without the individual owner's approval.

- a. Purpose of the study
- b. Background
- c. Objectives of the study
- d. Scope of the study

4. Description of Equipment
   - a. See Items 8 and 9 in this Program Plan
5. Applications in Nuclear Power Plants
   - a. See Items 9, 10, and 11 in this Program Plan
6. Failure Modes Description
   - a. See Items 9, 10, 11, and 12 in this Program Plan
7. Significant Events
   - a. Important Events
   - b. Important Precursors
   - c. Common Cause or Common Mode Failures
   - d. See Items 9, 10, 11, and 12 in this Program Plan
8. Failures and Precursor Descriptions
   - a. Design
   - b. Equipment Qualification
   - c. Application
   - d. Operation
   - e. Maintenance
   - f. Inservice Testing
   - g. Support System Failures
   - h. Common Mode and Common Cause Failures
   - i. See Items 9, 10, 11, and 12 in this Program Plan
9. Analysis and Evaluation of Operational Experience
   - a. Design
   - b. Equipment Qualification
   - c. Application
   - d. Operation
   - e. Maintenance
   - f. Inservice Testing
   - g. Support System Failures
   - h. Common Mode and Common Cause Failures
   - i. Safety Analysis
   - j. Risk Assessment(s)
   - k. See Items 9, 10, 11, and 12 in this Program Plan
10. Conclusions
    - a. Design
    - b. Equipment Qualification
    - c. Application
    - d. Operation
    - e. Maintenance
    - f. Inservice Testing
    - g. Support Systems and Equipment
    - h. Risk Assessment(s)
    - i. See Items 9, 10, 11, and 12 in this Program Plan
11. Recommendations

a. Design
b. Equipment Qualification
c. Application
d. Operation
e. Maintenance
f. Inservice Testing
g. Support Systems and Equipment
h. See Items 9, 10, 11, and 12 in this Program Plan

12. References
13. Figures
14. Tables
15. Appendices
    a. Listing of Pertinent LERs
    b. Listing of Pertinent Generic Communications
    c. Listing of Pertinent Failure Data and Incidents From Other NRC Sources
    d. Failure Data From Sources Other Than the NRC
    e. Trip Reports of Site Visits
    f. Abbreviations

B. Task 6.2 - Final Report includes:

1. INEEL peer review of the draft report,
2. NRC review of the draft report.
    a. NRR comments,
    b. RESEARCH comments.
3. Report should be revised to include response to the comments and resubmitted to the NRC TM.

XIII. Interim Progress Reports to NRC Technical Monitor and Program Manager

A. Weekly reports:

1. Addressed to NRC TM and PM,
2. Describe weekly progress and problems in standardized format.

B. Monthly reports:

1. Addressed to NRC TM and PM
2. Include description.

XIV. Program Review Points

A. Purpose:

1. To determine the extent and direction of remainder of effort.

B. Procedure:

1. NRC TM, PM and their management are to review progress of work to that point.

2. Notify INEEL PM of planned direction.

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISITS		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION Use separate sheets and refer to item numbers, if necessary.
1	Date.	
2	Name of Interviewer.	
3	Plant Name & Docket No.	
4	Person(s) Interviewed, Title(s), Phone Number(s), E-Mail address, short description of organization(s) and duties.	
5	If necessary, and if person(s) interviewed can do so, obtain any missing information not provided prior to the site visit, as described in the outline for Task 4 above. Note what information was provided.	
6	Describe plant events involving AOVs and provide reference information, if possible. Recent: Recurring: Significant:	
7	Describe AOV or air-system actual or detected potential failures at the plant? Provide reference information, if possible.	
8	Describe actions taken after events or failures involving AOVs or the air system. Provide reference information, if possible.	

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY
SITE VISITS

ITEM No.	INFORMATION	RESPONSE OR INFORMATION Use separate sheets and refer to item numbers, if necessary.
9	Were there any actual or potential common mode or common cause failures in the air system or AOVs at the plant? Describe and provide reference information, if possible.	
10	Describe root cause analysis procedures for the plant. Provide reference information, if possible.	
11	Describe root-cause analyses performed for air system or AOV failures at the plant. Provide reference information, if possible.	
12	Describe maintenance procedures for the air system. Provide reference information, if possible.	
13	Describe maintenance procedures for AOVs. Provide reference information, if possible. Safety-related: Important non-safety-related: Non-safety-related:	
14	Describe IST procedures for the air system. Provide reference information, if possible.	

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY
SITE VISITS

ITEM No.	INFORMATION	RESPONSE OR INFORMATION Use separate sheets and refer to item numbers, if necessary.
15	Describe IST procedures for AOVs. Provide reference information, if possible. Safety-related: Important non-safety-related: Non-safety-related:	
16	Describe diagnostic systems, if any, used for AOVs. Provide reference information, if possible. Description of system: Specifications: Data collected and frequency of collection: Vendor assistance provided, if any:	
17	Describe design (and analysis) procedures for AOVs. Describe how design basis is established and maintained for AOVs. Provide reference information, if possible.	
18	Describe analyses and/or testing for verification of operability during postulated transient or accident conditions. Provide reference information, if possible.	
19	Describe training for installation, maintenance, and testing of AOVs. Provide reference information, if possible.	

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISITS		
ITEM No.	INFORMATION	RESPONSE OR INFORMATION Use separate sheets and refer to item numbers, if necessary.
20	Describe databases used to track maintenance, failures, and events regarding AOVs. Provide reference information if possible. On site: Company wide: Industry:	
21	Describe the impact of the Maintenance Rule, 10 CFR 50.65 on AOV and air system maintenance and testing. Provide reference information if possible.	
22	Is PRA data used for predictive maintenance or replacement of AOVs? If so, how?	
23	Are AOVs serviced on site, serviced off site, or replaced as piece-parts if found to require service?	
24	Identify and describe the most common recurring maintenance problem(s) and failures regarding AOVs and the air system. What did you see? Provide reference information if possible.	
25	Interviewer comments regarding actual valves viewed during the visit, in the plant, undergoing maintenance or replacement, or in the plant stock system, if applicable to this interview.	

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY
SITE VISITS

ITEM No.	INFORMATION	RESPONSE OR INFORMATION Use separate sheets and refer to item numbers, if necessary.
26	Has the plant made changes to valves or systems that include AOVs, or replaced AOVs with different models of AOVs or different valves that are not AOVs? If so, describe the changes and the circumstances. What prompted the change? Was the change made for this plant only?	
27	Does the plant follow EPRI/NMAC guidelines for maintaining AOVs and the air system(s)? If not, describe differences and reasons for the differences. Provide reference information, if possible.	
28	What is the plant doing or planning to do in response to the recent Industry correspondence on AOVs. Provide reference information, if possible.	
29	Do you have any suggestions for improving the performance of AOVs, particularly in the areas of surveillance, testing, or maintenance?	
30	Provide a list of 10 CFR 50.59 and 10 CFR 50.72 reports on AOVs and AOV support systems (air or inert gas supply, etc.) that have been issued for this plant.	

TOPICS TO REVIEW FOR AIR OPERATED VALVE STUDY SITE VISITS		
ʼEM No.	INFORMATION	RESPONSE OR INFORMATION Use separate sheets and refer to item numbers, if necessary.
31	What thrust or torque margins are expected for AOVs? Are different margins used for safety-related, important non-safety-related, or non-safety-related AOVs?	
32	What maintenance or surveillance is done to AOV accumulators to ensure air/nitrogen quality and pressure? Were seismic considerations and size verified?	
33	Describe problems with pressure regulators, if any.	
34	Describe problems with feedwater regulating valves, if any.	
35	What, if any, is your involvement with the AOV Users Group? Describe.	
36	What is your view and response of the recent industry letter on AOVs? Describe.	

END

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