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EFFECTS OF ELECTRICITY DEREGULATION ON NUCLEAR POWER SAFETY

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OUTLINE OF THE STUDY

- **Historical case study approach (to maximize reliance on empirical information):**
  - **Literature reviews**
  - **Interviews**

- **3 case studies (chosen for their relevance to the U.S. nuclear power industry):**
  - **Deregulation of the U.S. aviation industry**
  - **Deregulation of the U.S. rail industry**
  - **Restructuring of the U.K. electricity industry**

- **Purpose:**
  - **Develop a complete list of changes relevant to safety**
  - **Emphasize changes with possible negative effects on safety**

TIME SCALE

- **Adjusting to deregulation is a lengthy process:**
  - **The air and rail industries were deregulated more than 20 years ago**
  - **All three case study industries are still undergoing significant changes in response to deregulation**

- **There is a long learning curve associated with deregulation**

OVERALL SAFETY PERFORMANCE

- A general decline in safety need not follow economic deregulation:
  - Both the air and rail industries in the U.S. had generally better safety records after deregulation
  - Nuclear plant managers in the U.K. focused more intently on regulatory compliance and hardware reliability after deregulation

- However, the magnitude and speed of the changes associated with deregulation pose substantial challenges to the management of safety:
  - Safety problems due to deregulation were observed in all three case study industries

SAFETY CULTURE

- **Deregulation creates major challenges to safety culture**

- **In aviation and rail, corporate culture adversely affected safety after mergers and acquisitions:**
  - **3 fatal accidents and 7 fatalities in 7 months after the Union Pacific/Southern Pacific merger**
  - **"Union Pacific's by-the book culture clashed badly with Southern Pacific's, …making do with chewing gum and bailing wire" (Passell, 1998, *New York Times*)**

- **New entrant airlines were substantially more risky than established airlines**

- **Underreporting of safety problems is reported to have increased in the railroad industry after deregulation**

SAFETY CULTURE (continued)

- In the U.K. nuclear power industry, corporate culture concerns dealt with use of contractors and loss of institutional memory:
  - "Few contractors understood the implications of the site licence"
  - "Neither were they aware of the licensee's safety standards and cultures" (Allars, 1999, U.K. Nuclear Installations Inspectorate)

- Safety regulators in the U.S. rail and U.K. nuclear power industries have proposed requiring prior review of major organizational changes that can affect safety

RE-PRIORITIZATION OF EXPENDITURES

- Companies in all three case studies undertook major re-prioritizations of their expenditures:
  - Airlines increased the amount of time between engine overhauls after deregulation, but did not experience a higher rate of engine failures
  - In the rail industry, annual capital expenditures on track maintenance increased by a factor of five, while employment was cut in half
  - The U.K. nuclear power industry also experienced dramatic downsizing after deregulation, coupled with increased use of contractors
- Such changes are not necessarily adverse to safety:
  - But can cause safety problems if organizations make excessive cuts in safety-related areas

FINANCIAL PRESSURES

- **Financial difficulties appear to be associated with safety problems in the rail and aviation industries**

- **The link between poor profitability and safety problems appears strongest for small and unprofitable companies (Rose, 1989, 1990):**
  - **"Lower profitability is correlated with higher accident and incident rates—particularly for smaller carriers"**
  - **"Smaller firms…may be more responsive to fluctuations in the economic environment"**
  - **"More intense scrutiny of the safety practices of financially marginal carriers is desirable"**

- **Companies in financial distress may have increased incentives to cut corners:**
  - **Therefore, financial difficulty may be a leading indicator of declining safety margins**

DOWNSIZING

- **Significant concerns were raised regarding downsizing and fatigue in the rail and U.K. nuclear power industries:**
  - **Federal investigations of major railroad accidents have identified inadequate staffing and fatigue as contributing factors (including after mergers)**
  - **In the U.K., regulators raised concerns that downsizing has led to loss of institutional memory and excessive reliance on contractors**

- **Safety regulators in both industries also raised concerns about increased use of overtime**

EXPERIENCES OF SAFETY REGULATORS

- **Workload increases:**
  - **The FAA experienced staff and budget cuts around the time of deregulation, and later found that its staffing levels were insufficient to meet the increased workload**
  - **U.K. Nuclear Installations Inspectorate (NII) increased staffing levels in anticipation of privatization**

- **Importance of organizational factors and safety culture:**
  - **Safety regulators in both the rail and U.K. nuclear power industries found it advisable to begin requiring prior regulatory approval of significant organizational changes:**
    - **Major mergers and acquisitions (rail)**
    - **Downsizing and outsourcing (U.K.)**

- **"NII expects licensees to demonstrate that proposed changes are fully considered before… implementation" (Reiersen, 1999, U.K. NII)**

CONDITIONS FAVORABLE TO SAFETY

- In all three case studies, circumstances favorable to safety may have counteracted safety problems due to deregulation:
  - The decades-long trend of improving safety in aviation may have masked adverse safety consequences of deregulation
  - The improved financial performance of the rail industry as a result of deregulation was conducive to safety
  - Rail deregulation took place at a time when the Federal Railroad Administration was becoming more active in safety regulation
  - The years immediately following nuclear power privatization in the U.K. were accompanied by extensive financial subsidies
  - The NII was actively involved in planning for and monitoring the transition to privatization in the U.K.

CONDITIONS FAVORABLE TO SAFETY (continued)

- **These favorable conditions may not be present in the U.S. nuclear industry:**
  - **Therefore, safety improvements similar to those in the aviation and rail industries may not be observed**

- **In the absence of such favorable conditions, deregulation could have greater adverse impacts on safety in the U.S. nuclear power industry than in the case study industries**

SUMMARY—CONDITIONS WITH THE POTENTIAL FOR NEGATIVE EFFECTS ON SAFETY

- **Long learning curve**
- **Major re-prioritization of expenditures:**
  - **E.g., maintenance**
- **Challenges to safety culture:**
  - **Mergers and acquisitions**
  - **New entrants**
  - **Other management changes**
  - **Pressures to under-report**
  - **Use of contractors**
  - **Loss of institutional memory**
- **Financial pressures**
- **Downsizing:**
  - **Inadequate staffing**
  - **Excessive overtime**
  - **Increased use of contractors**
  - **Loss of institutional memory**
- **Increased workloads for safety regulators**

SUMMARY—CONDITIONS WITH THE POTENTIAL FOR NEGATIVE EFFECTS ON SAFETY (continued)

- **Other possible effects:**
  - **Aging of equipment**
  - **Effects on human capital (e.g., skill/experience)**
  - **Reduced support services (e.g., engineering)**
  - **Reduced bench-marking**
  - **Poor labor relations**

OVERALL LESSONS LEARNED

- **Deregulation is not incompatible with maintaining or even improving safety**

- **The magnitude and speed of the changes associated with deregulation create major challenges to the management of safety (Neuschel, 1988):**
  - **"Achieving safety under deregulation is a particularly demanding task that requires intensive management skill and dedication…**
  - ***"Safety can be managed even under deregulation*.**
  - **"But it takes total commitment, special know-how, a highly disciplined work force and exemplary skill by management."**

- **Careful review of safety problems encountered in other deregulated industries may make it possible to minimize similar problems in the U.S. nuclear power industry**