

DPM Exposure Control – An Integrated Approach

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The Challenge

- In January 2001, MSHA promulgated a rule limiting the concentration of diesel particulate matter (DPM) in workplace air in underground metal and nonmetal mines.
- Negotiations resulted in changes so that the limit is now on personal exposure (PEL) of underground workers to diesel particulate matter (DPM)
- The final level was based on the feasibility of utilizing newer engine technology, ventilation changes, and primarily emissions control technology to attain the final lower limit.
- MSHA recognized that the rule(s) were technology forcing
- MSHA and NIOSH provided guides to assist mines in meeting this challenge.

Background

- Partnership was formed among NIOSH, Industry, Labor, and MSHA to address issues and formulate solutions
- NIOSH conducted two, two-week tests in an isolated entry of a western metal mine and obtained the DPM and gaseous emissions "performance" of available control technologies, namely permanent diesel particulate filters (DPF), disposable particulate filter elements (DFE), biodiesel (soy and yellow grease), ultra low sulfur, and water-fuel emulsion, and #1 and #2 diesel fuel.

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Results

- Results showed effective DPM reductions in general and provided the solid engineering numbers that could be expected from the utilization of any of the tested technologies
- The study did not address the difficulties of implementation of any of the technologies
- Our experience with this and other mines caused us to suspect that they did not fully appreciate the complexity of the challenge
 - DPF's were being tried with little forethought and little or no success
 - Anecdotal stories indicated a lack of understanding of the technology and issues involved
 - The struggle was evident in regional mechanics meeting
- DEEP trap evaluation studies showed success as did some US mines primarily as a result of detailed planning

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Implementation Study

- Mid year 2005 we accepted the task of identifying and resolving the issues associated with implementing a DPM control program at a partnership mine
- A visit to the mine was revealing
 - They had a DPM champion selected as result of 2003 workshop
 - They proclaimed that maintenance was the best in the area
 - That ventilation was the best attainable
 - But, measurements revealed that workplace air quality was poor
 - Low emission engines were emitting large amounts of black smoke
- What was/is the problem?

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Symptoms

- DPM champion was a mechanic and worked within maintenance
 - Responsibility
 - No authority
 - Lack of needed expertise / confidence
 - Expected to work alone
- Solution – DPFs
 - Treated as just another engine / exhaust component
 - Applied to existing engines
 - No involvement with others – no buy-in
- No real management support
- Failures resulted

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General Observation

- When there has been success, there was a team approach involving ventilation, maintenance, production, and safety functions
 - Noranda Brunswick Mining and Smelting – DPFs are installed on loaders
 - Maintenance, Ventilation, Safety (sampling)
 - Inco, Stobie Mine, the DEEP research program
 - Diesel Team headed by Chief of Mines Ventilation
 - Mine foreman, Maintenance, ventilation, labour representatives, etc.
- When mines have difficulty
 - There is/was no team; single person with responsibility but no authority
 - Efforts among ventilation, production, maintenance, and safety departments were not coordinated
 - Absence of a technical expert
- A change in the general "culture" is necessary for successful control of DPM

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A "Fresh" Approach

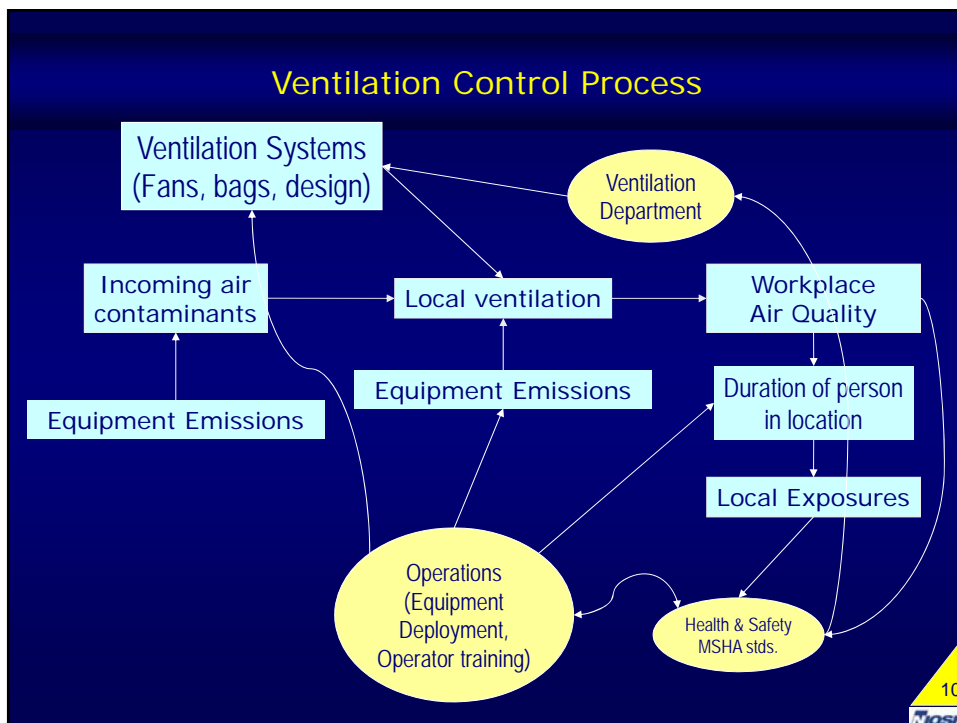
- How can NIOSH communicate the need for an integrated approach to DPM control?
- Reached back some 20 years to a model –
 - Treat workplace air quality is a manufactured product – a product of a "process"
 - Such a process is subject to process control techniques to assure quality of the final product
 - Process management brings together a team of all those who are responsible for controlling the quality of the final product

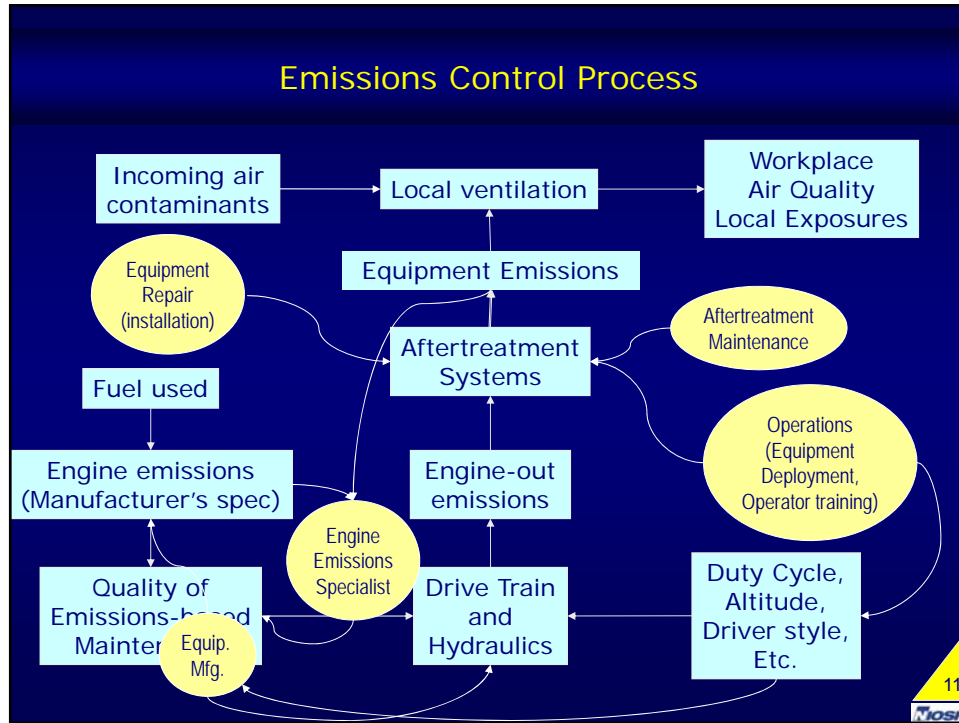
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Situation

- Utilization of diesel powered equipment created the “factory”
 - Created a process by which air quality was affected (negatively)
 - Usually was not accompanied by a management structure for managing the resulting “product” – workplace air
 - MSHA rules imposed quality standards on this product
 - Mines (some) operated with “business as usual”
 - Had no internal structure to address and cope with the problem

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- ### DPM control "team" experts
- **Ventilation**
 - Ensure adequate air quantity to control gases – CO₂ and NO₂ – for the deployed equipment
 - Calculate the additional air quantity to control DPM
 - Ensure systems are deployed, in proper repair, and function as designed
 - **Engine Maintenance**
 - Ensure that engine emissions are controlled to target levels at all times
 - Maintains control systems and support (back pressure gages)
 - **Production**
 - Specifies equipment deployment requirements
 - Trains operators to minimize emissions and observe malfunctions
 - **Safety and Health**
 - Monitors work place atmospheres, worker exposures
 - Provides information on contaminant control levels (ventilation)
 - Concerned with affects of controls worker safety and health

Conclusions

- Controlling workplace and/or personal exposures to DPM (and other diesel emissions) requires a high degree of interaction among specialized technical personnel
- A team approach is needed with all working towards the same goal and understanding constraints of individual functions
- There are specific roles and responsibilities of various "departments" – engine emissions QA, ventilation planning and QA, operations planning and driver education, etc.
- Successful management of air quality is as important as managing the process of getting the rock out of the ground.
- Additional subject matter knowledge is required
- Upper management commitment is required

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Questions



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