escalator," he says.

When "activated," macrophages can even secrete bacteria-killing compounds such as protein-degrading enzymes and reactive forms of oxygen, including hydrogen peroxide. Castranova found that rats that had inhaled coal dust for two years (at a rate equal to the current federal limit) began hypersecreting these reactive compounds. This overwhelmed the natural defense mechanisms in the lung and eventually led to the chemical breakdown of some lung tissue. He says this "autodestruction" — considered a possible cause of emphysema — now suggests why that respiratory disease usually precedes the onset of black-lung disease.

Because diesel exhaust depressed macrophage action in his study, Castranova says one might expect exposed animals to be more susceptible to infection. And that's what his colleagues Nicholas Hahon and Francis Green found; when mice exposed to low levels of exhaust for six months were infected with influenza virus, they indeed developed more severe infections than those breathing clear air or equal levels of coal dust.

What has proved quite provocative, Castranova says, is that when coal dust and diesel exhaust are delivered together, "the negative effects of each are canceled out" — a completely unexpected result. Because his study looked only at particle clearance in the lung, he cautions against reading his results to suggest inhaling diesel exhaust would actually benefit miners exposed to coal dust. Any apparent benefit here, he says, may well be offset by other types of hazards.

And in fact Trent Lewis, chief of NIOSH's experimental-toxicology branch in Cincinnati, pointed to one such possible offsetting hazard: A member of his staff measuring a different pulmonary parameter, lung function, found the combination of pollutants more detrimental to the monkeys and rats studied than either pollutant was when encountered alone.

Like Castranova's work, that research is among some two dozen experimental investigations that make up a recently completed NIOSH study of the health hazards associated with inhaling low levels of coal dust and diesel exhaust — alone and together. Though experiments focused on possible carcinogenic, pulmonary, immunological and mutagenic responses, other toxicological endpoints were also probed, explains Lewis. In fact, he says, "one of the novel aspects of this particular study is that it was run out of three divisions within NIOSH:" the Division of Respiratory Disease Studies where Castranova works; the Division of Biomedicine and Behavior where Lewis works; and the Division of Physical Sciences and Engineering, also in Cincinnati. All three divisions will release their findings to representatives of mining unions, government agencies and the coal industry at a day-long seminar on March 29. — *J. Raloff*

Using lasers to light up silicon swirls

Sandia National Labs

Scattered green laser light reveals where large silicon particles have been trapped in gas eddies. In the process of chemical vapor deposition (SN: 3/17/84, p. 165), silane (SiH_4) gas enters the chamber, and a complicated series of gas-phase chemical reactions occurs. Normally, the freed silicon atoms settle onto a heated plate to form a thin film, but under certain conditions, the atoms clump together before they reach the plate. The result is a surface film too rough for the fine features that must be laid down to make an integrated circuit. This photograph illustrates one experimental check on an elaborate computer model developed at the Sandia National Laboratories in Albuquerque, N.M., to provide a better theoretical understanding of the reactions that occur during chemical vapor deposition. So far, the model and experimental results agree closely.

Senate hears new lie detector proposals

Although the polygraph, commonly known as the lie detector, has been criticized recently as an inadequate tool for personnel screening (SN: 11/5/83, p. 292), the Department of Defense (DOD) has asked Congress for new powers to use the device to investigate persons being considered for jobs that involve sensitive information.

The proposals, presented recently to the Senate Armed Services Committee by Richard G. Stilwell, deputy undersecretary of defense for policy, follow the Reagan administration's retreat from a plan that would have required polygraph tests and lifetime censorship of writings and speeches for government employees with access to classified information. Rep. Jack Brooks (D-Texas) has written a bill now being considered in the House that would permanently ban the use of polygraphs and lifetime censorship agreements with federal employees.

DOD's proposals do not include lifetime censorship provisions, but they reaffirm the agency's confidence in the polygraph as an aid to internal security investigations. The department, says Stilwell, wants the following changes:

- All military personnel assigned to the National Security Agency (NSA) would be required to take a polygraph test. Questions would concern security risks of prospective employees, not personal or sexual habits. (All civilian employees and those under contract at NSA are now required to undergo a preliminary polygraph examination.)
- The director of the Defense Intelligence Agency would be allowed to require polygraph tests for what he designates as "critical intelligence positions" within his agency.
- Lie detector tests would be used as part of a full background investigation of DOD employees with access to sensitive information.

If employees refuse to take the tests, they could not be fired, says Stilwell; they would be put in a non-sensitive job of equal grade and pay. Those who refuse to take the tests at NSA, however, could be denied jobs at that agency.

A recent report by the Office of Technology Assessment (OTA), an investigative arm of Congress, that criticizes the use of the polygraph for security purposes is "inaccurate or incomplete," notes Stilwell. Lie detectors are not "infallible," he says, but they have been used carefully at DOD by trained examiners to help solve "a number of espionage cases" involving highly secret programs.

"We believe the mere possibility of being subjected to a polygraph examination will act as a powerful deterrent to those individuals who might consider an attempt to penetrate or compromise such programs," notes Stilwell.

Boston University psychologist Leonard Saxe, the principal author of the OTA report, opposed the expanded use of polygraph tests before the same Senate committee. Saxe, representing the American Psychological Association, says that some espionage agents are trained in methods that produce misleading polygraph readings. Agents who are the most dangerous to our national security have most likely been instructed in these methods, he adds. "Use of polygraph tests may lead to the false identification of innocent individuals and, more importantly in this situation, the failure to identify individuals who engage in espionage," contends Saxe. —*B. Bower*

News of the week continued on page 186