

Summary of Medical Screening and Surveillance Recommendations for

Workers Occupationally Exposed to Carbon Nanotubes and Nanofibers

February 3, 2011

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Screening and surveillance – WHY?

- ◆ Workers occupationally exposed to CNT/CNF may be at risk of adverse respiratory effects
- ◆ Among steps to minimize potential health risks associated with exposure to CNT and CNF

Worker Participation – WHO?

- ◆ Workers exposed to CNT/CNF at concentrations > REL [7 ug/m³ elemental carbon as an 8-hour time weighted average]
- ◆ Workers who have the potential for exposure to intermittent elevated airborne concentrations of CNT/CNF

Program Oversight

- ◆ Qualified health care professional



Screening – WHAT?

- ◆ Initial Evaluation
- ◆ Periodic Evaluations
- ◆ Written Report of Medical Findings



Screening – WHAT?

- ◆ Initial Evaluation
 - History
 - Physical Exam – focus on respiratory
 - Spirometry
 - CXR
 - Other – per professional judgment

Screening and surveillance – WHAT?

- ◆ Periodic Evaluations
 - Regular intervals
 - Possibly annual, per professional judgment
 - History, including respiratory symptom update
 - Physical exam
 - Consideration of specific tests

Screening – WHAT?

- ◆ Written Report of Medical Findings
 - Workers
 - Exam / test results
 - Opinion / recommendations concerning medical conditions, work-relatedness, need for PPE, etc.
 - Employer
 - Work / exposure restrictions
 - Opinions / recommendations concerning work-relatedness of conditions, need for PPE

* Confidentiality of medical records enforced per applicable regulations/guidelines

Worker Training

- ◆ Should include:
 - Nature of exposures
 - Potential health risks
 - Routes of exposure
 - How to report symptoms
 - Medical screening program

Periodic Evaluation of Data

- ◆ Qualified health professional
- ◆ Aggregate / evaluate data from screening program
- ◆ To identify patterns or trends in health / exposure related data that may assist prevention efforts

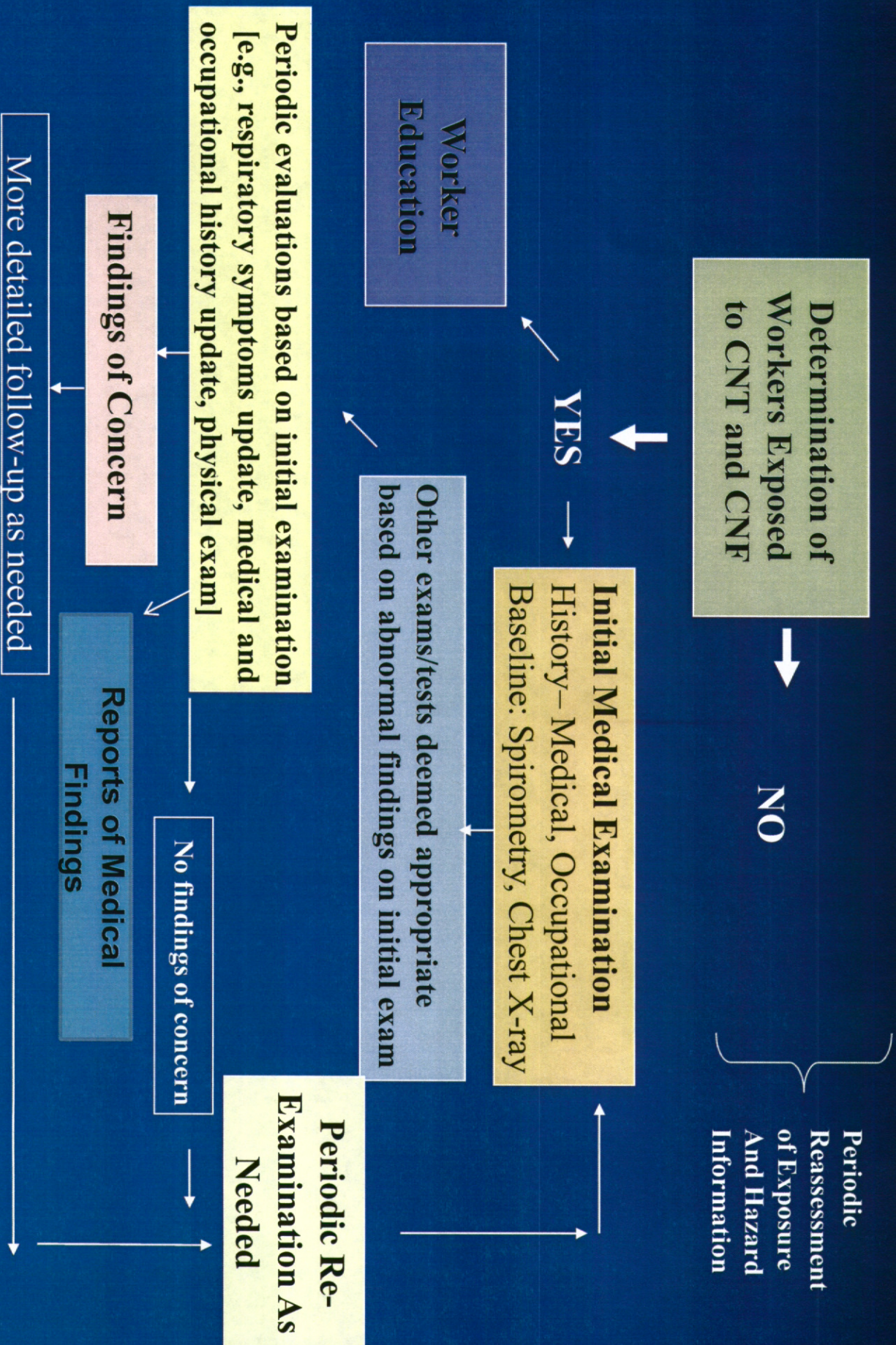


Periodic Evaluation Screening Program

- ◆ Employers
- ◆ Serving appropriate purpose
 - Consistent with current knowledge related to CNT / CNF



Medical Screening and Surveillance Recommendations – CNT and CNF



Determination of Workers Exposed to CNT and CNF

NO

Periodic Reassessment of Exposure And Hazard Information

YES

Initial Medical Examination
History – Medical, Occupational
Baseline: Spirometry, Chest X-ray

Other exams/tests deemed appropriate based on abnormal findings on initial exam

Periodic Re-Examination As Needed

Periodic evaluations based on initial examination
e.g., respiratory symptoms update, medical and occupational history update, physical exam]

Findings of Concern

Reports of Medical Findings

More detailed follow-up as needed

Worker Education

Occupational Health Surveillance

Ongoing systematic collection, analysis, and dissemination of exposure and health data on groups of workers for the purpose of preventing illness and injury

- ❖ Hazard Surveillance
- ❖ Medical Surveillance

Medical Surveillance

- ◆ Ongoing systematic collection, analysis, and dissemination of exposure and health data on groups of workers for the purpose of preventing illness and injury
- ◆ Medical surveillance is an established component of a complete safety and health management program
 - Examines health status through tracking of health outcome or change in biologic function of exposed person(s)
 - Longitudinal approach, recurrent examinations or analyses

Medical Monitoring (Screening)

- ◆ Can be considered one type of medical surveillance
- ◆ Medical testing/examination of individual or group of individuals
 - Detect preclinical changes or changes that occur in the very early stages of disease before an exposed person would normally seek medical care and when intervention is beneficial
- ◆ Cross sectional evaluation – one point in time

- ◆ Ongoing medical screening
 - Mandated by law or voluntary
 - ~ 32 OSHA standards require screening
 - *NIOSH recommends medical screening*

Goals of Medical Surveillance

- ◆ Identify new hazards or outcomes
 - Detecting changes early
- ◆ Identify trends and track distribution
- ◆ Estimate magnitude
- ◆ Information to target intervention
- ◆ Generally considered secondary prevention
 - ◆ May contribute to primary prevention

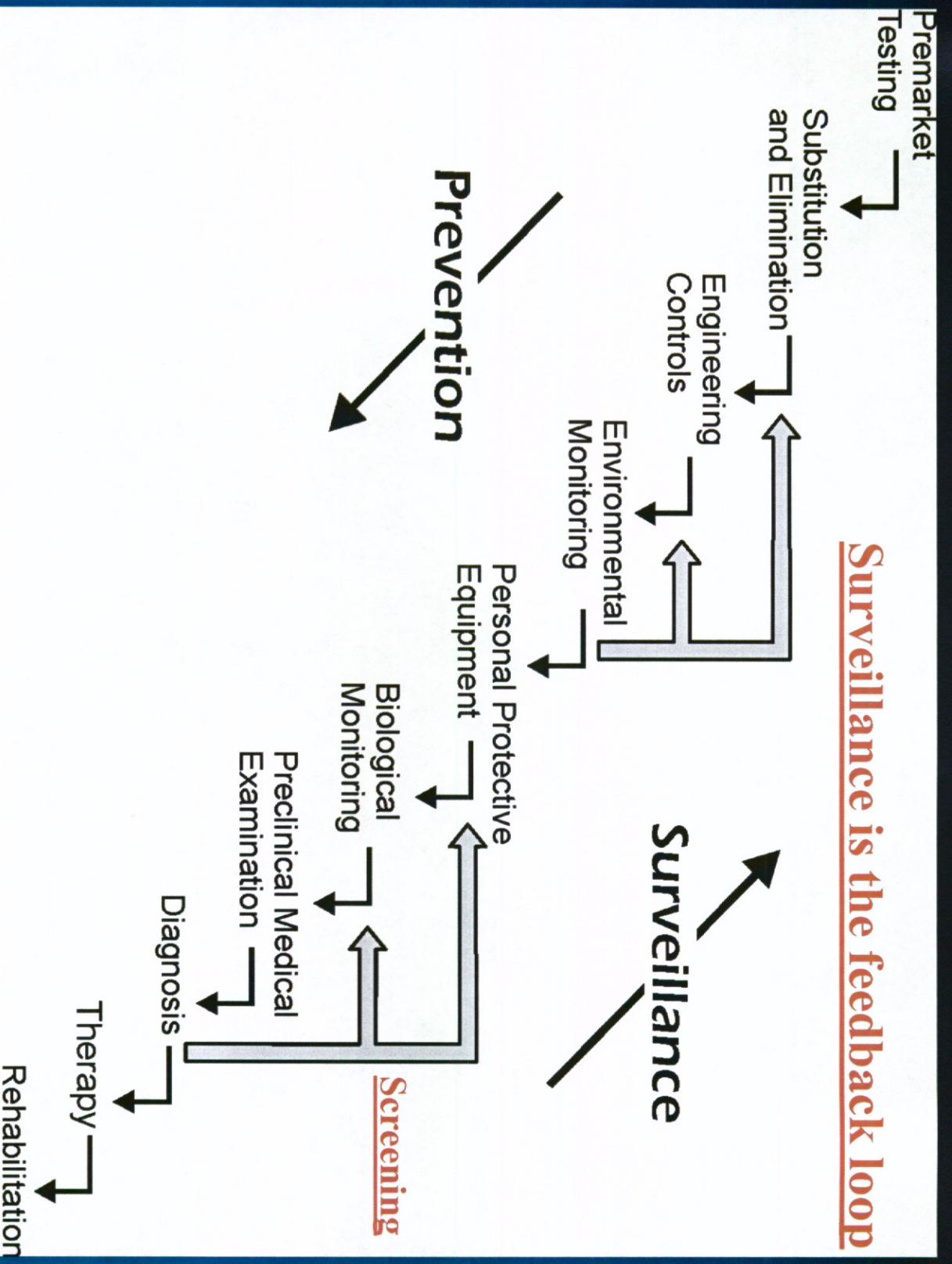


Figure 1. The cascade of occupational health prevention with examples of surveillance feedback (Adapted from Halperin 1996)¹⁴

Medical Surveillance Program – Elements

- Defined purpose/objective
- Target population
- Testing modalities
 - Questionnaires
 - Exams - Content, frequency
 - Tests - Types

Medical Surveillance – Considerations with Testing

- Properties of the test being considered
 - Accuracy, reproducibility
 - Sensitivity, specificity
 - Positive predictive value, negative predictive value
- Important characteristics may vary depending on the health outcome and circumstances of monitoring program

Medical Surveillance/Screening – Benefits and Concerns

- ◆ Benefits – related to goals of surveillance/screening
 - Considerations – characteristics of tests, health outcome
 - Secondary prevention
 - Early detection
 - Primary prevention?
- ◆ Concerns
 - Adverse effects of testing (e.g., radiologic studies)
 - Generation of “uninterpretable” data
 - “Costs” of false positives or false negatives
 - potential follow-up of “false positive” tests
 - Resources

Criteria for establishing medical surveillance/screening recommendations

- Historically, driven by hazard identification and development of exposure limit
- What hazard / exposure data will be needed to guide new recommendations concerning medical surveillance?