ASEAN Movement in Radiology

AIR Pneumo, a project to standardize chest radiograph interpretation of occupational lung diseases in Thailand and ASEAN countries: Challenges and future trends

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Abstract

This article compiles multiple operations to establish the standard for experts in interpreting chest radiographs of pneumoconiosis, based on the International Labour Organization's (ILO) classification standards in Asia under the name 'AIR Pneumo.' The project began in Thailand and expanded to other countries, especially in the ASEAN region. It has been supported by the National Institute for Occupation Safety and Health (NIOSH). A memorandum of cooperation was signed to maintain the training standards of the program at an international level and to address the shortage of NIOSH B Readers in the region. The training courses and examinations have been organized in Thailand. The transition from film-based radiographs to digital imaging presents a future challenge for AIR Pneumo's operations, which aligns with the World Health Organization's policy to eliminate pneumoconiosis.

Keywords: AIR Pneumo, Chest radiography, ILO classification, NIOSH B Reader, Pneumoconiosis.

To eliminate silicosis in workplaces by 2030 in line with the International Labour Organization (ILO) and the World Health Organization (WHO)'s Global Programme for the Elimination of Silicosis (GPES) [1], Thailand established the National Programme for the Elimination of Silicosis (NPES) in 2001. In 2006, the Asian Intensive Reader of Pneumoconiosis (AIR Pneumo) was established as an academia-based quality assurance program for physicians' proficiency in reading chest radiographs for pneumoconiosis [2]. By the end of 2019 before the 1st Covid-19 pandemic, AIR Pneumo had successfully conducted its training and examination programs in several countries [3]. Originally, the Central Chest Institute of Thailand (CCIT) was the only institution that could accommodate candidates for the AIR Pneumo training and examination programs. In 2016, it was expanded to the Philippines, Indonesia and Vietnam.

Besides contributing to the expansion of AIR Pneumo's operations across various ASEAN countries, the CCIT has also maintained the high standards of AIR Pneumo's trainers through collaborations with the National Institute for Occupation Safety and Health (NIOSH), part of the Centers for Disease Control and Prevention (CDC) of the Department of Health and Human Services (HHS) of the United States of America (U.S.) to contribute to the prevention of occupational injuries and diseases in both Thailand and the U.S.

NIOSH's Respiratory Health Division (RHD) conducts the NIOSH B Reader Program and offers monthly examinations at Morgantown, WV, NIOSH facility. The NIOSH B Readers are specialized physicians trained and certified to classify findings of pneumoconiosis on chest radiographs using the ILO classification system. Typically, to be a certified NIOSH B Reader, one has to take the examination at NIOSH facility or other NIOSH-administered sites in the United States. When the Memorandum of Understanding Between the CCIT, Department of Medical Services, Ministry of Public Health of Thailand and the NIOSH, CDC, Department of Health and Human Services of the U.S. was initiated, the 2-days training course was offered by NIOSH and the B Reader examination has been administered in Thailand. As a result, this has increased accessibility and decreased incurred costs, making more physicians available to classify radiographs for pneumoconiosis in Thailand and overseas countries.

AIR Pneumo Program: Objectives

1. To develop experts in reading radiographs of pneumoconiosis according to the standards set by the ILO
2. To train and enhance the knowledge of physicians working in fields related to occupational lung diseases, enabling them to accurately interpret radiographs of occupational lung diseases in line with the ILO classification standards
3. To assess experts and provide certification by the Asia Regional Cooperation Committee, the "AIR Pneumo Committee"
4. To facilitate the exchange of knowledge, insights, and experiences among experts both within and outside the country, particularly in the Asian region
5. To create a network of academic colla-

borations on occupational lung diseases between Thailand and other countries in the Asian region
6. To establish a standard for experts in Thailand and the Asian region that aligns with international standards

Standards for Experts in Interpreting Chest Radiographs for Occupational Lung Diseases

To standardize the interpretation of chest radiographs as accurately as possible, the ILO developed a classification system for reading chest radiographs to detect pneumoconiosis (ILO classification) [4]. This system aims to improve the quality of chest radiograph reading and maintain the expertise of physicians in using the ILO classification standards.

To ensure that experts maintain high competency in using the ILO classification, the U.S. NIOSH developed the B Reader certification program in 1974 [5].

Based on ILO classification standards, a training for reading chest radiographs of pneumoconiosis is conducted by NIOSH, a U.S. government agency responsible for research and recommending protection measures against occupational hazards. However, to become a certified B Reader, one must travel to the United States to take the exam, which makes it difficult for medical personnel in developing countries in the ASEAN region to access this expertise.

Establishing a regional standard for experts in interpreting occupational lung disease radiographs in Asia addresses the region's shortage of B Reader experts. This initiative aims to reduce diagnostic issues and complaints regarding unreliable diagnoses.

Project Implementation: Establishment of the AIR Pneumo Committee in 2006 [3].

To continuously implement and develop the training and examination program for pneumoconiosis radiograph experts to meet international standards, the CCIT under the Department of Medical Services, Ministry of Public Health, in collaboration with the Bureau of Occupational and Environmental Diseases, Department of Disease Control, and the Faculty of Medicine, Fukui University, Japan, serves as the core organization in establishing international cooperation and networks across Asian countries. The ILO supported the initiative, establishing the AIR Pneumo Committee in 2006. Professor Yukinori Kusaka from the Faculty of Medicine, Fukui University, Japan, was the founding chairman. Currently, the committee includes experts from Japan, Brazil, India, Indonesia, and Thailand.

The AIR Pneumo Committee operates through international cooperation as follows:

1. CCIT, Department of Medical Services, Ministry of Public Health of Thailand
2. Scientific Committees on Respiratory Disorders, International Commission on Occupational Health (SCRD, ICOH)
3. Japan Society for Occupational Health (JSOH), Research Group for Occupational Lung Diseases (RG-OLD)
4. The Association of Occupational and Environmental Diseases of Thailand (AOET), Research Group for International Cooperation in Occupational Health

5. Bureau of Occupational and Environmental Diseases, Department of Disease Control, Ministry of Public Health of Thailand
6. Asian Pacific Society of Respirology (APSR)
7. ILO
8. Workmen's Compensation Fund, Social Security Office of Thailand

Collaboration between Experts from Various Institutes and Organizations within the Country

To maintain the high standards of expertise among trainers in the program, the CCIT, through its Radiology Department, has assembled a group of expert trainers to read radiographs of occupational lung diseases according to the ILO classification standards in Thailand. These trainers passed the NIOSH B Reader certification examination in 2004 and now serve as trainers and advisors for the program in Thailand.

The group comprises highly respected experts from various organizations, including the Department of Medical Services, the Faculty of Medicine at Prince of Songkla University, Chulalongkorn University, and Mahidol University. This collaboration ensures that the training program is supported by a wealth of experience and knowledge, contributing to the development of skilled professionals in occupational lung diseases.

Fostering Collaboration between Organizations and Agencies in ASEAN Countries

In 2014, the CCIT, through its Radiology Department, organized an international collaboration meeting among ASEAN countries to develop expertise in reading chest radiographs of occupational lung diseases (pneumoconiosis) according to the ILO classification standards. "The ASEAN Conference for the Development of National Readers for ILO Classification" meeting was held from July 28th -30th in Chiang Mai, Thailand [3].

Representatives from ASEAN countries attended the conference, including Brunei, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Thailand, and Vietnam. The meeting concluded that enhancing the ability of physicians to interpret radiographs of occupational lung diseases (pneumoconiosis) is essential for effective surveillance and prevention of these diseases. The training programs can be organized through regional cooperation among ASEAN countries, with support from international organizations, notably the ILO. The CCIT serves as the primary organization for conducting trainings and has developed plans to expand training initiatives to other regional countries. This collaboration aims to strengthen the region's ability to manage occupational lung diseases and improve diagnostic accuracy across ASEAN.

Development of the Workshop Training and Expert Certification Program for Reading Chest Radiographs of Pneumoconiosis According to ILO Standards in the Asian Region (Asian Intensive Reading of Radiographs of Pneumoconiosis)

1. In 2004, the first training and certification exam for reading chest radiographs of pneumoconiosis according to the ILO standards (NIOSH B Reader certification) was held in Thailand. This

event resulted from the collaboration between the Department of Disease Control, the ILO, and Professor Yukinori Kusaka from the Faculty of Medicine, Fukui University, Japan. The CCIT sent three physicians to attend the training, and all three successfully passed the evaluation. In total, there were nine certified physicians in Thailand. Prior to this, training courses based on the ILO classification for radiologists and occupational medicine physicians had been conducted by NIOSH since 1995 and in 2002. These sessions focused on educating and training physicians in reading radiographs without certification as NIOSH B Readers.

2. The CCIT, through its Radiology Department, organized a meeting with NIOSH B Readers (certified in 2004) in Thailand with support from the AIR Pneumo committee and ILO. At that time, nine certified experts from various organizations in Thailand participated, including specialists from the Faculty of Medicine at Chulalongkorn University, Mahidol University, Prince of Songkla University, and the CCIT, as well as radiologists from Rajavithi Hospital and Lerdsin Hospital. This group collaborated to develop a curriculum, determine the course content, and plan the first AIR Pneumo workshop in 2008. An introductory ILO classification training course was organized in 2007. Afterward, the CCIT became the only institution capable of organizing trainings and certification for the AIR Pneumo program, which has been held biennially. By 2018, the CCIT had conducted the sixth training program in Thailand, with participants from beyond ASEAN countries, including Bhutan, Hong Kong, India, and Taiwan, among others.

However, in 2020, the COVID-19 pandemic disrupted the ability to hold training sessions in Thailand. The AIR Pneumo program was eventually resumed in 2023 as the seventh training session.

Expansion of AIR Pneumo Training Program and Evaluation of Experts to the ASEAN Region

1. We expanded the AIR Pneumo training program outside of Thailand for the first time in the Philippines. The ILO/AIR Pneumo Training Workshop on the Asian Intensive Reading of Radiographs of Pneumoconiosis was held in Manila, the Philippines from July 26th-28th, 2016.

2. In 2018, we expanded the training and examination program to Indonesia for the first time. The workshop was held at Universitas Indonesia-Persahabatan Hospital, and later extended to Universitas Indonesia-Depok Hospital, in collaboration with the Indonesian Society of Respirology (ISR) and the Indonesian Occupational Medicine Association (IOMA). Several more training and evaluation sessions

were organized in Indonesia afterward.

3. In 2019, we expanded the training and evaluation program to Vietnam for the first time, held from September 16th -19th.

By the end of 2020, before the training programs were paused due to the COVID-19 pandemic, the AIR Pneumo project had successfully conducted 26 training and evaluation sessions in various countries, including India, the Philippines, Vietnam, Indonesia, Brazil, Japan, and Thailand. Thailand has undertaken the AIR Pneumo training program for the 7th time, while Indonesia hosted it for the 6th time in 2023.

Collaboration with the NIOSH, U.S.

To maintain the standards for NIOSH B Readers in Thailand, the CCIT, through its Radiology Department, with support from the Department of Disease Control and ILO, has been coordinating with NIOSH, U.S., to organize continuous NIOSH B Reader trainings and certification examinations in Thailand since 2004. Currently, the CCIT is the only primary institution in Thailand that conducts assessments and renewals for NIOSH B Reader experts. The most recent certification was held in 2019, marking the fourth session of this evaluation.


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AIR Pneumo Training Workshop:
(A) the instructors and trainees of the 6th Workshop, held at the CCIT, Thailand on 19th-21stDecember 2018,
(B) the 5th Indonesian Workshop, held at the Persahabatan Hospital, Jakarta. on 29th-31st January 2023,
(C) the 7th Workshop in Thailand, held at the CCIT on 6th-8th December 2023,
(D) the atmosphere in the room during the practical training session at the CCIT, Thailand,
(E) the atmosphere in the examination room for certifying experts in the AIR Pneumo program in Thailand,
(F) the instructors and trainees of the 7th Workshop in Thailand.

The Achievements in Terms of Both Quantity and Quality:

I. AIR Pneumo Training and Examination

a. Course Content: Asian Intensive Reading of Radiographs of Pneumoconiosis according to ILO Classification

1. Pneumoconiosis in Thailand
   Reference documents [6,7]
   - Medical and Health Data Repository, Ministry of Public Health of Thailand
   - Data Center, Department of Industrial Works, Ministry of Industry of Thailand
2. Introduction to ILO Classification of Radiographs of Pneumoconiosis and AIR Pneumo Training Project.
   - Overview of ILO Classification and AIR Pneumo Project
3. Basic Principles and Quality in Chest Radiography
   - Understanding the basic principles behind chest radiography and grading the quality of the images.
4. Review of ILO Standard Radiographs & Recording in the Reading Sheet
   - In-depth examination of the ILO's standard radiographs and proper documentation of readings.
5. Review of Additional Symbols
   - Understanding additional symbols used in the interpretation of radiographs.
6. Review of Pleura Abnormalities
   - Interpretation of pleural abnormalities visible in radiographs.
7. Review of Small Rounded and Irregular Opacities
   - Interpretation of small opacities and irregular patterns within the lung tissue.
8. Review of Large Opacities
   - Review and understanding of large opacities found in chest radiographs.
9. Self-Practice of X-Ray Film Reading and Recording Results (30 Films)
   - Participants will practice reading 30 radiographs within 90 minutes (3 minutes per film). This will help trainees build confidence and skill in reading pneumoconiosis films according to ILO standards and systematically recording the results on a form.
   - The session will involve providing answers, reviewing results, and resolving questions with the assistance of the instructors.
     Reference materials for practice:
     - "ILO Classification of Radiographs of Pneumo-coniosis Handbook (Revised Edition, 2000)" [Certified Translation]
     - Guidelines for the Use of the ILO International Classification of Radiographs of Pneumoconioses (Revised Edition 2011)
     - Guidelines for the Use of the ILO International Classification of Radiographs of Pneu-

moconioses (Revised Edition 2022)

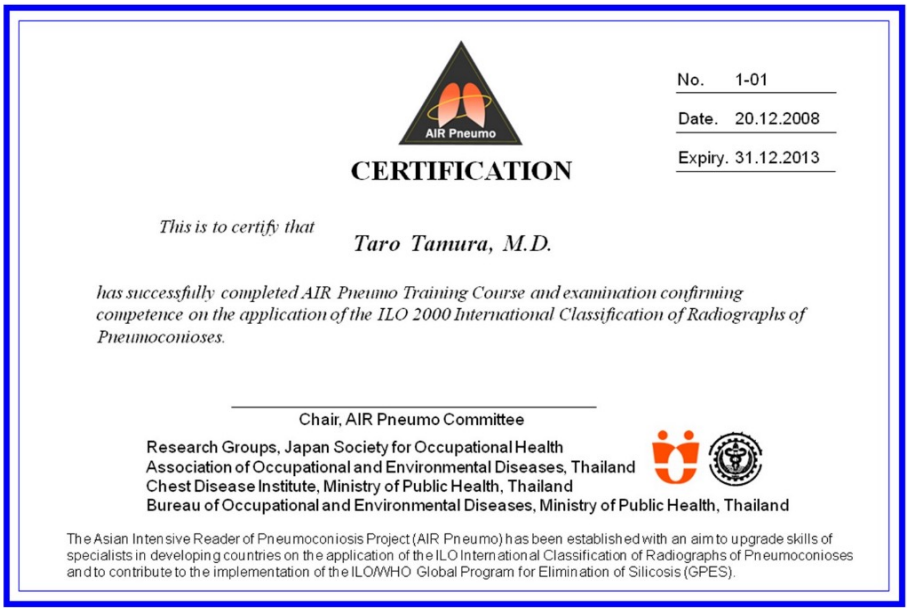
b. Certification of Experts Through the ILO Classification Radiograph Evaluation
To establish a standard for interpreting radiographs of pneumoconiosis, the AIR Pneumo Committee organizes practical exams based on the ILO Classification. These exams are managed and supervised by a committee from Japan.

c. AIR Pneumo Expert Certification
It is certified by the Chair of the AIR Pneumo Committee.

d. Eligibility for Examination:
   1. Specialists in AIR Pneumo seeking a certification renewal
   2. Radiologists, pulmonologists, and occupational medicine specialists who have completed the AIR Pneumo training program

e. Examination:
   - Number of Films for Evaluation: 60 films in 3 hours [8,9].
   - Answer Sheets: These will be sent for evaluation, and AIR Pneumo Japan will return the results.

f. Grading:
   - New Candidates: Must achieve at least 60% to be awarded the AIR Pneumo Expert Certification (Asian Intensive Reader of Pneumoconiosis). The certification is valid for 4 years (extended to 5 years starting in 2018).
   - Renewal Candidates: Must score at least 80% to maintain their status as an AIR Pneumo expert.


AIR Pneumo

No. 1-01
Date. 20.12.2008
Expiry. 31.12.2013

CERTIFICATION

This is to certify that

Taro Tamura, M.D.

has successfully completed AIR Pneumo Training Course and examination confirming competence on the application of the ILO 2000 International Classification of Radiographs of Pneumoconioses.

Chair, AIR Pneumo Committee
Research Groups, Japan Society for Occupational Health
Association of Occupational and Environmental Diseases, Thailand
Chest Disease Institute, Ministry of Public Health, Thailand
Bureau of Occupational and Environmental Diseases, Ministry of Public Health, Thailand

The Asian Intensive Reader of Pneumoconiosis Project (AIR Pneumo) has been established with an aim to upgrade skills of specialists in developing countries on the application of the ILO International Classification of Radiographs of Pneumoconioses and to contribute to the implementation of the ILO/WHO Global Program for Elimination of Silicosis (GPES).

Certificate of Expertise in AIR Pneumo on interpretation of pneumoconiosis chest x-rays according to the ILO standards in the Asian region.

Table 1. *The number of new trainees who passed the evaluation examination per evaluation. session (n= 265 participants).*

Time/Year	Thais	Others	Total
1st /2008	23/24 (96%)	4/5 (80%)	27/29 (93%)
2nd /2010	20/21 (95%)	2/3 (67%)	22/24 (92%)
3rd /2012	13/14 (93%)	3/3 (100%)	16/17 (94%)
4th /2014	22/24 (92%)	7/9 (78%)	29/33 (88%)
5th /2016	19/21 (91%)	12/13 (92%)	31/34 (91%)
6th /2018	22/22 (100%)	26/37 (70%)	48/59 (81%)
7th /2023	59/62 (95%)	6/7 (86%)	66/69 (96%)
Total	**178/188 (95%)**	**60/77 (78%)**	**238/265 (90%)**

The CCIT has organized training sessions to enhance the knowledge of doctors working with occupational lung diseases, enabling them to accurately interpret chest X-rays of occupational lung diseases according to the ILO classification. Until 2023, the Institute has conducted expert evaluation exams in Thailand 7 times, with 265 doctors participating in the trainings and 238 individuals successfully passed the evaluation exams to become certified experts, resulting in a pass rate of 90%. The certification is endorsed by the chairperson of the AIR Pneumo Committee (Asian ILO) in Japan. The training and evaluation involved both local and international experts, fostering the exchange of opinions, knowledge, and experiences. The number of new trainees and those who passed the examination is demonstrated in Table 1. Regarding others, the number of new trainees from countries in Asia and Africa was 77. The details were shown in Table 2.

Table 2. *The number of new trainees from various Asian countries per evaluation session (n=77 participants).*

Year	2008 1st	2010 2nd	2012 3rd	2014 4th	2016 5th	2018 6th	2023 7th	Total
Japan	2	1	-	-	-	-	-	3
China	1	-	1	-	-	-	-	2
Republic of Congo	1	-	-	-	-	-	-	1
India	-	1	-	-	1	7	-	9
Hong Kong	-	-	1	-	1	-	-	2
Pakistan	-	-	1	-	-	-	-	1
Taiwan	-	-	-	-	-	3	-	3
Mongolia	-	-	-	-	-	-	-	2*
Bhutan	-	-	-	-	1	-	-	1
Indonesia	-	-	-	5	7	17	1	30
Malaysia	-	-	-	-	2	9	3	14
Philippines	-	-	-	1	1	-	-	2
Vietnam	1	1	-	-	-	-	-	2
Cambodia	-	-	-	2	-	1	-	3
Laos	-	-	-	-	-	-	-	1
Brunei	-	-	-	1	-	-	-	1
Total	**5**	**3**	**3**	**9**	**13**	**37**	**7**	**77**

**no data of time to participate*

In cooperation with the AIR Pneumo Committee, for the development of experts in interpreting pneumoconiosis chest X-rays according to the standards of the ILO in the ASEAN region. The Institute has supported training programs in various countries, including the Philippines, Indonesia, and Vietnam. A total of 289 individuals participated in the trainings, and 211 individuals successfully passed the evaluation and received the AIR Pneumo expert certification, resulting in a pass rate of 73% (Table 3).

Table 3. *The number of new trainees who passed the evaluation examination held in ASEAN countries (n=289 participants).*

Month/Year	Country	City	Passed/Participant (Individual)(%)
07/2016	Philippines	Manila	20/21 (95%)
02/2018	Indonesia	Jakarta	34/40 (85%)
02/2019	Indonesia	Jakarta	34/43 (79%)
08/2019	Indonesia	Jakarta	20/36 (56%)
09/2019	Vietnam	Hanoi	38/55 (69%)
02/2020	Indonesia	Jakarta	32/39 (82%)
01/2023	Indonesia	Jakarta	14/26 (19%)
10/2023	Indonesia	Jakarta	19/29 (66%)
Total			**211/289 (73%)**

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II. NIOSH B Reader Examination in Thailand

The CCIT, in collaboration with the NIOSH of the U.S., has organized the NIOSH B Reader certification examination in Thailand to maintain the standard of experts, trainers, and consultants in Thailand and the ASEAN region at an international level every four years since 2004, totaling four times. Currently, there are 16 NIOSH B Readers in the ASEAN region, with 15 from Thailand and 1 from Indonesia. As of May 25th, 2022, there are 88 international NIOSH B Readers worldwide.

The pass rate for new exam takers is 27%, with 21 out of 79 new exam takers passing. The pass rate for re-examinees is 67%, with 26 out of 39 re-examinees passing. The overall pass rate is 43%, with 59 successful attempts out of 137 total attempts (Table 4).

Table 4. *The number of participants who took the NIOSH B Reader expert evaluation examination in ASEAN Countries from 2004 to present (n=137 sessions).*

Time/year	Passed/Participants		Total
	Thais	Others	
1st /2004	9/20 (45%)	-	9/20 (45%)
2nd /2011			12/19 (63%)*
3rd /2015	20/26 (77%)	2/5 (40%)	22/41 (54%)
new examinees	6/17 (35%)	1/4 (25%)	7/21 (33%)
re-examinees	14/19 (74%)	1/1 (100%)	15/20 (75%)
4th /2019	15/24 (63%)	1/33 (3%)	16/57 (28%)
new examinees	4/ 7 (57%)	1/31(8%)	5/38 (13%)
re-examinees	11/17 (65%)	0/2 (0%)	11/19 (58%)
**no data to classify new examinee or re-examinee*			
Total: new examinees	**19/44 (43%)**	**2/35(6%)**	**21/79 (27%)**
Total: re-examinees	**25/36 (69%)**	**1/3 (33%)**	**26/39 (67%)**
		Total	**59/137 (43%)**

All achievements were initiated by the quality assurance of the AIR Pneumo course, including all selected films that have already been published [3, 8, 9, 10, 11, 12].

Challenges and Future Trends

Currently, traditional film-based X-rays are being phased out and replaced by digital imaging systems for interpreting chest X-ray images. The transition from film to digital technology requires careful preparation in several areas, including resources, equipment, digital image examples for training and examinations, and personnel who are experts in the technology. Ensuring that the system meets the standards and remains effective is a challenge for AIR Pneumo, as it strives to update its training and examination systems in line with current technological advancements.

The NIOSH B Reader Program has now updated its training and examination system from the film-based method for interpretating pneumoconiosis to a digital image-based approach. The most recent examination in Thailand was successful when conducted on 17th-20th December, 2024 (the official exam results have not yet been announced). However, due to work station limitations, the program could not accommodate all interested candidates or those needing certifications as experts.

This situation requires us to acknowledge and address the need for improvement in the training and examination systems for AIR Pneumo in the future. It poses a challenge, requiring careful preparation and potentially the redesign of training and examination systems to keep pace with the rapidly changing technologies.

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