



## SSI PROTOCOL FOR ASTHMATIC DIVERS

Duke H. Scott, M.D.  
SSI Medical Advisor

### PREFACE

Scuba Schools International (SSI) is dedicated to meeting the needs of all people, including those with disabilities, providing them with the opportunity to reach their fullest potential and enhancing the quality of their lives. In accordance with this philosophy, SSI is proud to expand their role in dealing with disability issues as they apply to the diving community. After several years of study and research by Dr. Duke Scott and others, SSI is now prepared to initiate a program which will allow qualified asthmatics to participate in scuba training. SSI has adopted the protocol for asthmatics and will be working in conjunction with Dr. Duke Scott to implement this protocol.

Asthma affects more than 14 million Americans. At least 75 percent of asthmatics demonstrate hypersensitivity to airborne allergens. Atopy, the genetic predisposition for the development of IgE antibodies to common allergens, is an accepted risk factor for asthma among children and adults. In addition to allergens, numerous activities, or exposures that precipitate or exacerbate episodes of asthma, have been identified. These "triggers" include viral infections, environmental pollutants, medications, foods, sustained exercise, cold, and emotional distress. Identification and avoidance of these allergens and triggers are important components of asthma management. They obviously are important in determining which asthmatics can safely participate in scuba training and scuba diving.

During the 1990's improved strides were made in the management of asthmatic individuals. The reason for this is two-fold. First, there was the realization that asthma is a chronic inflammatory disease involving the lungs' bronchial tree. This changed the focus of treatment from symptomatic therapy to preventive therapy by utilizing medications that inhibit or reduce bronchial inflammation. Second, a multitude of anti-inflammatory drugs have been developed. These new drugs offer a prolonged period of action and therefore increased protection during periods of increased exertion, such as during scuba. These two factors have revolutionized the treatment of mild to moderate asthmatics. This allows us to approach asthmatics based on their level of function as opposed to their classification. That is, their ability to exercise is independent of whether or not their asthmatic condition requires medication for control.

In the third edition of *Diving Medicine* (1997), Dr. Tom S. Neuman discusses the case for and against asthmatic scuba divers. I found his case for allowing selective asthmatics to participate in scuba programs very compelling. I recommend that any SSI Instructors who contemplate teaching asthmatics to dive become familiar with his recommendations.

Dr. Neumann first discusses the studies and concepts that are most frequently used to argue against diving for asthmatics. He then explores these studies, showing how some of the results may have been misinterpreted. In fact, new studies are described that contradict some of the previous findings. Lastly, he reports on two recent symposia, attended by diving-medicine experts, which concluded that "asthma did not predispose to diving-related pulmonary barotrauma" and that "the limiting factor for asthmatics is adequate ventilatory capacity underwater."

In light of their conclusions, Dr. Neumann suggests that the research data to this point does not support the absolute banning of all asthmatics as diving candidates. Also, the diving community cannot ignore the excellent safety record of the many "closet" asthmatic divers in the United States and certified asthmatic divers of the British Sub-Aqua Club. The B.S.A.C. does not certify exercise-induced asthmatics. On the other hand, we cannot ignore the data that suggests the potential risk of barotrauma is greater in asthmatics. Still, it is obvious that asthmatics are a very heterogeneous group with varying degrees of respiratory difficulties. Therefore, as with diabetics, each asthmatic's eligibility for scuba training should be evaluated on his or her own merits.

Based on these findings, the SSI Program recommends the following guidelines for determining which asthmatics are fit to participate in our scuba training programs. This protocol should be used by a potential asthmatic scuba student in consultation with his or her physician to determine eligibility for scuba training. Once accepted, the student must be closely monitored by the instructor. If the student's



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asthma becomes symptomatic during pool training or open-water dives, he or she must be dropped from the class and disqualified from further scuba training.

The SSI Program will begin accepting qualified asthmatics as scuba students as of June 1, 2001. Initially, all potential asthmatic scuba students are required to receive clearance by the SSI Medical Advisor prior to being accepted into an instructor's class. The reason for this is twofold. The first is to be sure that the student and SSI are covered by our professional liability insurance. Our insurance will only cover us if the asthmatic meets the requirements set forth in the Protocol. Second, the SSI training of asthmatics will be closely scrutinized by the other diving agencies as a whole. Therefore, we must monitor the progress of these individuals closely, not only during their training, but also during their entire diving experience. The data we accumulate will be utilized to confirm our position that select asthmatics are fit to dive. It will also be used to modify the Protocol as needed and to aid us in developing more effective teaching methods. Every instructor who chooses to teach asthmatics will be required to submit data concerning the students' response to scuba training. Every asthmatic student will be requested to periodically submit information concerning his or her diving activities. The necessary forms and method for reporting this information will be provided by the SSI Medical Advisor. The SSI instructor and/or the asthmatic student's physician should contact the SSI Medical Advisor, Dr. Duke Scott, if they have any questions or problems concerning the use of the Protocol.

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### PROTOCOL

- I. Qualified Asthmatics.
  - A. Presently asymptomatic and on no medication, although history of asthma during infancy and/or childhood:
    1. Qualified for scuba if otherwise physically fit;
    2. Additional asthmatic screening not required;
    3. Physician clearance recommended but not required.
  - B. Presently symptomatic but well-controlled on medication and classified as mild intermittent or mild persistent asthmatic:
    1. Qualified for scuba if they successfully meet the criteria for being functionally stable (below) and are otherwise physically fit;
    2. Additional asthma screening required (below);
    3. Clearance by personal physician and the SSI Medical Advisor;
    4. Well-defined predictable triggers.
- II. Unqualified Asthmatics
  - A. Classification of severe, persistent asthma.
  - B. Symptoms not controlled by maintenance medication.
  - C. Rescue inhaler or medication required during exercise, stress, or exposure to a cold environment.
  - D. Otherwise not physically fit.
  - E. Poorly defined triggers; that is, asthma attacks occur for no apparent reason (triggers undefined) and are unpredictable.
  - F. On over-the-counter medications for asthma and not under the supervision of a physician.

### ASTHMATIC SCREENING

- I. Pulmonary Function Tests.
  - A. Normal resting and exercise studies, including normal tests for flow rates, static lung volumes, and vital capacity. There should not be a degradation in pulmonary function after exercise. To qualify for scuba training the drop in peak-or mid-expiratory flow between rest and exercise may not exceed 20%.
  - B. Testing should be performed with patient on routine preventive medication.
  - C. Methacholine challenge testing is contraindicated.
- II. Functionally Stable.
  - A. Asthmatic is able to exercise and tolerate stress without becoming symptomatic while on maintenance medications.
  - B. Asthmatic does not require "rescue" inhalers, etc., during times of stress or exertion.



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## ASTHMATIC DIVER MEDICAL FORM SUPPLEMENT

The SSI program is now accepting qualified asthmatics for scuba training. The criteria for qualifying are outlined in the SSI Asthmatic Protocol. Your patient should provide you with a copy of the Protocol, SSI Medical Questionnaire, and the SSI Medical Form. Please review and complete each form appropriately.

SSI's training of asthmatic divers is in its infancy. Consequently, we are asking you to give us a considerable amount of information. We appreciate your efforts in helping us collect this data. Your efforts will assist us in ensuring the fitness and safety of asthmatic scuba divers. The data will enable us to modify the Asthmatic Protocol as needed. Strict adherence to the asthmatic screening outlined in the Asthmatic Protocol is essential to ensure the safety of asthmatics underwater.

### Asthma History

Classification of asthma \_\_\_\_\_ Age at onset \_\_\_\_\_  
Type of asthma: Allergic \_\_\_\_\_ Exercise \_\_\_\_\_ Other \_\_\_\_\_  
"Triggers" \_\_\_\_\_ Frequency of attacks \_\_\_\_\_  
Severity of symptoms \_\_\_\_\_ Degree of control \_\_\_\_\_  
Maintenance medications \_\_\_\_\_  
Rescue inhaler use \_\_\_\_\_ Does patient smoke? Yes \_\_\_\_\_ No \_\_\_\_\_  
Patient's degree of function with regard to exercise \_\_\_\_\_

### Pulmonary Function Tests

Pulmonary Function Tests While on Maintenance Medication

Resting: Normal \_\_\_\_\_ Abnormal \_\_\_\_\_ Date \_\_\_\_\_  
Exercise: Normal \_\_\_\_\_ Abnormal \_\_\_\_\_ Date \_\_\_\_\_

a. There should not be a degradation in pulmonary function after exercise. To qualify for scuba training the drop in peak- or mid-expiratory flow between rest and exercise may not exceed 20%.  
Please attach a copy of PFT's to this form.

### Peak Flow Meter Monitoring

1. Is patient is competent after PFM monitoring? Yes \_\_\_\_\_ No \_\_\_\_\_
2. Patient's personal best peak flow number is \_\_\_\_\_.

### Physician's Acknowledgement

After examining \_\_\_\_\_ and reviewing all the material presented to me, I consider him/her physically fit to participate in the SSI training program. I consider this patient's asthma to be functionally stable on his/her maintenance medication. Patient should be able to undergo strenuous activity without requiring the use of a rescue inhaler.

Signature \_\_\_\_\_, M.D./D.O.

Printed name \_\_\_\_\_

Address \_\_\_\_\_

Phone (\_\_\_\_) \_\_\_\_\_ Email \_\_\_\_\_

Suggestions with regard to the Asthmatic Protocol, Medical Form, etc. \_\_\_\_\_

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If you have any questions or concerns please contact the SSI Medical Advisor, Duke H. Scott, M.D.



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### INSTRUCTIONS FOR SSI INSTRUCTORS TEACHING ASTHMATICS

The Protocol for Asthmatic Divers enables SSI scuba instructors to accept qualified asthmatics as candidates for SSI scuba training. Also, as long as the asthmatic student fits the criteria outlined in the Protocol and the instructor follows the guidelines for teaching asthmatics, then the instructor will be covered by SSI liability insurance. At first the instructor will be required to monitor each asthmatic student closely and submit forms documenting his or her progress. Once we have collected sufficient data to support our position on the training of asthmatic divers, these guidelines and instructions can be liberalized accordingly.

The following instructions should be followed by SSI instructors when selecting and training asthmatics for scuba diving:

1. The instructor should have an understanding of the Asthmatic Protocol.
  2. The instructor should accept only asthmatics who fit the criteria laid out in the Asthmatic Protocol.
  3. Pre-course approval by the student's physician and the SSI Medical Advisor is required.
  4. The instructor should become familiar with the technique of peak flow meter monitoring. (See "Using Your Peak Flow Meter.")
  5. Pool Training
    - a. If the asthmatic student is symptomatic or has a respiratory or sinus infection, he or she should not participate in pool training or open water dives until the problem is resolved.
    - b. Observe the student perform peak flow meter monitoring before each pool session and open-water dive. Only allow the student to participate in the planned activity if the meter reading is in the accepted peak flow zone—at least 80% of student's personal best.
    - c. Document that the asthmatic student has taken his or her prescribed medication properly on the day of the pool training or open water dives.
    - d. If the asthmatic student becomes symptomatic (wheezing, shortness of breath, or other signs of respiratory distress) during the pool training or open-water dives, ABORT the activity immediately.
    - e. Students who become symptomatic during pool training or open water dives must be dropped from the scuba class and disqualified from further SSI training. The instructor is required to document the incident and report it to the SSI Medical Advisor.
    - f. Any disqualified asthmatic student may apply for reinstatement once his or her physician has stabilized the asthmatic condition. Reinstatement requires the approval of the student's instructor, personal physician, and the SSI Medical Advisor.
    - g. Once the asthmatic student successfully completes his/her scuba training the instructor is required to submit this fact to the SSI Medical Advisor in a timely manner.
- The instructor should provide the asthmatic candidate's physician with the following material:
6. SSI Medical Questionnaire – to be completed by the student;
  7. SSI Medical Form – to be completed by the physician;
  8. SSI Protocol for Asthmatic Divers – including asthmatic screening procedure, instructions to asthmatic diver, instructions to scuba instructor, and instructions for using peak flow meter;
  9. SSI Asthmatic Medical Form – to be completed by physician.
7. The instructor will provide the SSI Medical Advisor with copies of the completed questionnaire and forms on the student, and any other information the instructor considers pertinent.
  8. After the required material is received by the SSI Medical Advisor, the instructor should expect confirmation of the asthmatic's fitness for scuba training within 48 hours.
  9. **Failure to comply with the above instructions may leave the SSI instructor without liability insurance coverage if the asthmatic student were to develop complications during scuba training.**



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## ASSUMPTION OF RISKS AND GUIDELINES FOR ASTHMATIC DIVERS

I, \_\_\_\_\_, understand that asthmatics who choose to scuba dive assume some additional risks. The major risk is the potential for developing an asthmatic attack while underwater. Such an attack could lead to drowning, arterial gas embolism, hypoxia, or other catastrophic events. I accept these risks. I have discussed the SSI Asthmatic Protocol with my physician and we have determined that I meet the criteria to qualify for scuba training. I agree to follow all the recommendations outlined below.

- 1) I will only perform conservative, recreational dives according to the SSI dive tables and/or dive computer guidelines.
- 2) I will only dive with an informed buddy who is aware of my condition and properly trained.
- 3) I will understand my limitations and dive within them.
- 4) I will take my medications correctly.
- 5) I will not dive when suffering from any respiratory or sinus infection.
- 6) I will not dive when my asthma is symptomatic.
- 7) I will perform peak flow meter (PFM) monitoring before and after each dive. I will only dive if my PFM reading is within the accepted peak flow zone – at least 80% of my personal best peak flow number.
- 8) I will always carry my maintenance and "rescue" medications with me when diving (on the boat, shore, etc.). My informed buddy will know its location, proper use, and dosage.
- 9) If symptoms of asthma develop I will abort the dive immediately.
- 10) After suffering from an asthmatic attack I will not return to diving until completely asymptomatic and my peak flow rate is normal.
- 11) I will avoid extreme environmental conditions such as strong currents, cold water, and other potential hazards until I am certain they are not "triggers" for my asthma.
- 12) I will keep a dive log. I will record each dive and include medications taken, presence or absence of symptoms, corrective measures taken (if needed), environmental conditions, pre- and post-dive peak flow meter values, and the name of my informed dive buddy.
- 13) If I am allergic to insect stings (bees, etc.), venomous plants (poison ivy, etc.), or aquatic inhabitants (jelly fish, corals, venomous fish and/or plants), on dive trips I will carry some form of injectible Epinephrine (EpiPen Auto-Injector, etc.) and/or other recommended medication. My informed buddy and I will be prepared and willing to administer this medication to me if the need should arise.
- 14) I am willing to participate in annual SSI follow-up surveys to evaluate the effectiveness of the SSI Asthmatic diver Program.
- 15) **I will follow recommended ascent rates on every dive and not exceed them.**

I have read each guideline and understand them. Furthermore, I agree to follow them during my scuba-diving activities.

Student's name \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

(If minor, signature of parent or guardian is required.)

Instructor's name \_\_\_\_\_ # \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_



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## SSI ASTHMATIC STUDENT TRAINING REPORT

### Personal Information

Student \_\_\_\_\_ DOB \_\_\_\_\_ SSN \_\_\_\_\_  
 Address: Street \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_  
 Mailing Address (if different)  
 Street \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_  
 Home Phone ( ) \_\_\_\_\_ Business ( ) \_\_\_\_\_ Email \_\_\_\_\_  
 Age \_\_\_\_\_ Sex \_\_\_\_\_ Race \_\_\_\_\_  
 Asthma Classification: Mild Intermittent \_\_\_\_\_ Mild Persistent \_\_\_\_\_  
 Asthma Type: Allergic \_\_\_\_\_ Exercise \_\_\_\_\_ Other \_\_\_\_\_  
 "Triggers" \_\_\_\_\_  
 Maintenance Medications (type, dose, frequency) \_\_\_\_\_

Personal Best Peak Flow Meter Reading \_\_\_\_\_

### Personal Physician

Name \_\_\_\_\_  
 Street \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_  
 Telephone( ) \_\_\_\_\_ Email \_\_\_\_\_

### Pool Training Record

|  |           |          |
|--|-----------|----------|
| Took medication as prescribed prior to pool sessions.                    | Yes _____ | No _____ |
| Performed peak flow meter monitoring before and after each pool session. | Yes _____ | No _____ |
| All meter readings in accepted range (80% of student's personal best).   | Yes _____ | No _____ |
| Asymptomatic during and after pool sessions                              | Yes _____ | No _____ |
| No pool sessions missed because of asthma.                               | Yes _____ | No _____ |
| Successfully completed pool training.                                    | Yes _____ | No _____ |
| Explain any "no" answers in detail. _____                                |           |          |

### Open Water Dives Record

|  |           |          |
|--|-----------|----------|
| Took medication as prescribed prior to all dives.                      | Yes _____ | No _____ |
| Performed peak flow meter monitoring before and after each dive.       | Yes _____ | No _____ |
| All meter readings in accepted range (80% of student's personal best). | Yes _____ | No _____ |
| Asymptomatic during and after dives.                                   | Yes _____ | No _____ |
| No dives missed because of asthma.                                     | Yes _____ | No _____ |
| Successfully completed open water dives.                               | Yes _____ | No _____ |
| Explain any "no" answers in detail. _____                              |           |          |

### Attach a copy of asthmatic's open water dive log, including:

- Dive profiles (SSI tables and computer if used)
- Environmental conditions – especially temperature of water
- Medications taken on day of dive
- Presence of absence of symptoms (if present) and corrective measures taken
- Peak flow meter readings before and after dives
- Peak flow meter readings during the presence of any symptoms
- Name of informed buddy

### Tricks, Traps, Techniques

Please provide comments on any tricks, traps, or techniques experienced or utilized that might improve the Asthmatic Protocol or SSI training of asthmatic divers. \_\_\_\_\_

Student signature \_\_\_\_\_ Date \_\_\_\_\_  
 Instructor name \_\_\_\_\_ # \_\_\_\_\_  
 Instructor signature \_\_\_\_\_ Date \_\_\_\_\_



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## GENERAL INFORMATION ON ASTHMA FOR SSI INSTRUCTORS

### 1. Asthma Triggers

- a. Sources of inhaled allergens: house dust mites, animal dander from house pets, pollen, fungal spores, cockroaches, etc.
- b. Infections: viral respiratory infections, sinusitis, etc.
- c. Gastroesophageal reflux: persistent heartburn, hiatal hernia, etc.
- d. Environmental irritants/precipitants: tobacco smoke, cold air, exercise, cold water, particulates from wood stoves, air pollution, chemical gases or fumes, insect stings, venomous aquatic creatures, aquatic pollutants, etc.
- e. Drugs: aspirin, non-steroidal anti-inflammatory drugs (Motrin, Advil, Aleve, and similar anti-arthritic and pain medications), alcohol, caffeine, over-the-counter stimulants, herbs, etc.
- f. Preservatives: sulfites used as preservatives in food, beer, wine, etc.
- g. Emotional stress: anxiety, etc.

### 2. Using a Peak Flow Meter

A peak flow meter (PFM) is a device used to measure the resistance to airflow out of an individual's lungs. It measures "peak expiratory flow rate." The "PEFR" is the force with which an individual can expel air from his lungs. In asthmatics, it helps determine the degree of airflow obstruction they are experiencing. During an asthma attack, the bronchi (airways) of the lung become gradually more constricted. The worse the constriction, the more restrictive the airflow. The proper use of a PFM enables asthmatics to determine if their bronchi are becoming constricted, often hours or days before any symptoms develop. Essentially, asthmatics use a PFM to monitor the status of their asthma. PFM monitoring allows asthmatics to adjust their medical management depending on the status of their asthma. It also helps asthmatics determine if it is safe for them to participate in potentially hazardous activities such as scuba diving.

- a. How to use a peak flow meter
  - (1) Move the indicator to the "zero" end of the numbered scale.
  - (2) Stand up.
  - (3) Take the deepest breath that you can.
  - (4) Place the mouthpiece in your mouth and seal your lips around it.
  - (5) Blow out as hard as you can.
  - (6) Record the number on the flow meter's scale upon which the indicator lands.
  - (7) Perform the maneuver three times and accept the highest number as your PFM reading.
- e. Interpretation of peak flow meter readings
  - (1) Personal Best Highest peak flow number reached by an individual over a three-week period of daily monitoring when the asthma is under good control (asymptomatic and feeling well). **Normal personal best PEFR is 500.**
  - (2) Good Control When PEFR is 80%-100% of personal best (400 to 500). **Fit to dive.**
  - (3) Caution When PEFR is 50%-79% of personal best ( 250 to 400). **Unfit to dive – seek medical attention.**
  - (4) Medical Alert When PEFR is less the 50% of personal best (0 to 250). **Unfit to dive – get immediate medical attention.**



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### Classification of Asthmatics According to Symptoms and Lung Function

Adapted from National Heart, Lung and Blood Institute, National Asthma Education Program; "Expert Panel Report II: Guidelines for the Diagnosis and Management of Asthma"; Clinical Practice Guideline Series; Bethesda, Maryland; National Institutes of Health, National Heart, Lung and Blood Institute, NIH Publication Number 97-4051

| Classifications   | Daytime Symptoms  | Nighttime Symptoms                      | Lung Function  |
|-------------------|---|---|--|
| Mild Intermittent | Symptoms occur up to two times per week. Episodes are brief (hours to days), with normal PEFr and no symptoms between episodes. | Symptoms occur up to twice a month.     | PEFR or FEV greater or equal to 80% of predicted. Less than 20% variability in PEFr. |
| Mild Persistent   | Symptoms occur more than twice a week but less than once a day. Episodes may affect normal activity.                            | Symptoms occur more than twice a month. | PEFR or PEV greater than or equal to 80% of predicted. PEFr variability 20% or 30%.  |
| Severe Persistent | Symptoms are continual. Physical activity is limited. Episodes are frequent.  | Symptoms are frequent.                  | PEFR or PEV less than 60% of predicted. PEFr variability greater than 30%.           |

**Key** PEFr: Peak Expiratory Flow Rate\*

PEV: Forced expiratory volume in one second\*

\*Before initiating medical therapy