Nano Research Facility User Policy
Washington University in St. Louis, August 2013

This document is a reference manual covering the basic operational policies for use of the Nano Research Facility (NRF) at Washington University in St. Louis, a member of the National Nanotechnology Infrastructure Network (NNIN-WUSTL). NRF includes core facilities in Elemental and Molecular Analysis, Imaging, Micro and NanoFabrication, Metrology and Surface Characterization, and Particle Synthesis and Characterization. The NRF satellite facility, the Jens Molecular and Nanoscale Analysis Laboratory, is a shared materials analysis facility supported by core faculty in the department of Energy, Environmental, and Chemical Engineering. All of our labs house state-of-the-art instruments and serve as a multi-user facility with qualified users having access around the clock. As a result, **it is truly important for all NRF users to have read and understood laboratory policies before using laboratory equipment**.

It is impossible, however, to define a policy for every conceivable situation. Rules and policies are no substitute for common sense. Under these conditions, **anyone who fails to act in a professional, safe, and responsible manner while in the NRF will be banned from further use of the facilities**. However, suggestions and feedback on the facility, its operation, and its equipment are welcome at all times. Please feel free to direct your suggestions to the laboratory manager.

1. General Procedures

1.1Categories of Users

Professional Staff	Academic Users from WUSTL	Other Academic Users	Industrial Users	Off-hour Users	Regular-hour Users
Full or part time employees of NRF and its satellite facilities.	Faculty, postdocs, graduate students, and undergraduate students from WUSTL working on research projects.	Faculty, postdocs, graduate students, and undergraduate students from other academic institution working on research projects. OR Company research scientists working on a collaborative project with an academic institution or a government funded research project (not for commercial projects).	Engineers and research scientists from a company working on product research and development or production of commercial products.	Users working after regular hours Monday to Friday and on weekends (qualification tests are required to get off-hour access).	Users working during regular hours Monday to Friday when staff is available for assistance.

1.2Access

All users must present documentation verifying that they have passed **WUSTL Environmental Health and Safety Laboratory training** and **NRF Lab Specific Safety and Ethics training** before gaining access to the facility. Based upon the successful completion of training sessions for the use of the equipment in NRF laboratory professional staff will provide a door access key-code or will activate the users card swipe access. Sharing of key codes or ID cards that provide unauthorized access to the facility is not allowed. **Loaning your ID card to others is a serious violation!** Non-authorized persons are prohibited from accompanying, observing and helping users at work, unless specifically approved by laboratory professional staff. For users who are inactive for one year or more new training sessions are required.

1.3Hours of Operation

Use is restricted to normal hours (9:00 a.m. to 5:00 p.m. Monday through Friday) for regular-hour users. The labs are open to qualified off-hour users both day and night, weekdays, and weekends. Not all instruments are available off hours and in some cases a "buddy" system is required for off-hours use. Users have to reserve the use of instruments online (http://nnin.seas.wustl.edu/fom/). More information on rates and hours is given in section 2.3.

1.4Facility Governance and Appeals

The laboratory manager is responsible for the continued operation of the facility. Use of the facility by any user is at the sole discretion of the management. The laboratory manager and the staff are responsible for maintaining and enhancing the equipment resource of the facility, and for assuring that the operational policies of the facility are followed. **On matters involving equipment usage or safety, you must follow direct instructions from the staff.** Both staff and users are expected to act in a courteous and professional manner at all times. Deviations from this norm by either users or staff should be reported to the laboratory manager immediately. If at any time you, as a user, feel that you have been unfairly treated by a staff member or strongly disagree with the rules imposed by a staff member, please discuss the situation with the laboratory manager.

2. Equipment Use and Availability

2.1. Registration

Users are required to use online registration (http://nano.wustl.edu/GetStarted.aspx) to contact the laboratory manager to indicate your interest in the use of the NRF. You must provide all of the information requested on the registration form. The laboratory manager will evaluate the potential research projects that you will work on and will assign professional staff to provide the required hands-on training sessions (on-site users) or perform service work (remote users). Upon evaluation, laboratory manager and professional staff can authorize you as a user of the NRF for access to the facility and for online reservation for use of the instrument.

Much of the equipment in the facility is delicate. As a result, direct hands-on access to any equipment by the end-user may be severely restricted or prohibited. We consider hands-on access as an important part of the educational process. We set rules and procedures for the use of any instrument to assure the continued operation of the instrument. **Violation of these procedures or carelessness in operation can result in damage to the equipment, downtime and considerable expense. Consequently, carelessness or damages caused while using any equipment will result in suspension of user privileges, either for a specific instrument or the facility as a whole.**

2.2 Training

All on-site users must receive training from NRF staff on each instrument they wish to use. Users can arrange for a training session with an "instrument manager". The user is responsible for checking in five minutes prior to the appointment, and if the user does not show up within fifteen minutes of the scheduled appointment time, the training session will be cancelled, and the user charged for a 1-hour training session as penalty (see **User Fees** below). The training session currently uses a standard sample for training. For instruments requiring two training sessions the user is encouraged to bring his/her own sample in the follow-up session.

All users must complete the online Nano-Ethics training found at http://nano.wustl.edu/GetStarted.aspx**.**

All on-site users must complete the online Nano Lab Safety training found at http://nano.wustl.edu/GetStarted.aspx**.**

All on-site users must complete Washington University lab safety training and provide the Lab Manager with a copy of their Compliance Profile. If you are an on-site user not from Washington University contact the Lab Manager to receive a WUSTL key.

2.3 User Fees

The hourly or per use based charge for equipment pays for expendables and maintenance and upkeep costs. In some cases additional consumable costs may apply. Industrial rates are comparable to those charged by commercial suppliers of equivalent services where applicable. User fees for use of instrumentation are outlined below. **Failure to pay usage charges will result in cancellation of your project or facility access being revoked.** Please discuss charges with the laboratory manager if you have any questions.

All internal (WUSTL) users will be billed at the end of each month for accumulated user charges via budget number.

External users may choose to be billed by work order or at the end of each month and can pay by purchase order, credit card, or check.

- **Users are responsible for logging in at the beginning of their session using their NRF-FOM System username and password, and for logging out at the end of their session, which is how User Fees are determined.**
- **Users are charged for reserved time or used time, whichever is longer.**
- **Users will be automatically logged out of their session 30 minutes after the end of their reservation time.**
- **Users must cancel instrument reservations at least 8 hours in advance to avoid late cancellations fees. Late cancellation fees are set at the price of one hour of instrument use during regular hours.**

NRF-A: Academic User
NRF-I: Industrial User
R: Regular Hours (9:00 am - 5:00 pm M-F)
O: Off Hours (5:00 pm - 9:00 am M-F and weekends)

Assistant fee includes training and/or service by NRF staff.
Additional consumable fees may apply.

Micro-and Nanofabrication (Clean Room): BUDDY SYSTEM REQUIRED FOR OFF-HOUR USE	
1,000 & 100 Bay Cleanroom Access NRF-A: $25/day NRF-I: $60/day Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**Mask Aligner and Spin Coater** NRF-A: $5/hr (R) and $5/hr (O) NRF-I: $25/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
Reactive Ion Etch NRF-A:$20/hr (R) and $15/hr (O) NRF-I:$60/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**Ellipsometer** NRF-A:$5/use NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour

Profilometer NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**Electrical Probe Station** NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
Thermal Evaporator NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**PVD** NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
Tube Furnace NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**Soft Lithography** NRF-A:$15/use NRF-I:$30/use Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour

Metrology and Surface Characterization	
Profilometer NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**Ellipsometer** NRF-A:$5/use NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
Atomic Force Microscope NRF-A: $15/hr (R) and $5/hr (O) NRF-I: $60/hr Assistant for NRF-A:$40/hr Assistant for NRF-I:$100/hr	**Electrical Probe Station** NRF-A:$5/hr NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
Zeiss Imager A1 Optical Microscope NRF-A: $5/hr (R) and $5/hr (O) NRF-I: $10/hr Assistant for NRF-A:$40/hr Assistant for NRF-I:$100/hr	

Elemental and Molecular Analysis	
PerkinElmer ELAN DRC II ICP-MS NRF-A:$20/hr (R) and $10/hr (O) NRF-I:$60/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**PerkinElmer Optima 7300DV ICP-OES** NRF-A:$20/hr (R) and $10/hr (O) NRF-I:$60/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
Agilent 1100 High Pressure Liquid Chromotography NRF-A:$10/hr (R) and $5/hr (O) NRF-I:$60/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	

Imaging	
FEI Spirit TEM NRF-A: $30/hr (R) and $15/hr (O) NRF-I: $150/hr Assistant for NRF-A:$60/hr Assistant for NRF-I:$100/hr	**FEI Nova 2300 SEM** NRF-A: $40/hr (R) and $15/hr (O) NRF-I: $150/hr Assistant for NRF-A:$60/hr Assistant for NRF-I:$100/hr
Zeiss Observer A1 Optical and Fluorescent Microscope NRF-A: $5/hr (R) and $5/hr (O) NRF-I: $10/hr Assistant for NRF-A:$40/hr Assistant for NRF-I:$100/hr	**Sectioning (Leica Ultramicrotome)** NRF-A:$20/hr (R) NRF-I:$150/hr Assistant for NRF-A: $60/hour Assistant for NRF-I: $100/hour
TEM Sample Fixation, Embedding, Staining NRF-A: $25/sample NRF-I: $50/sample	**Gold Sputter Coating** NRF-A:$10/run (max of 90 seconds) NRF-I:$25/run (max of 90 seconds) Assistant for NRF-A: $20/run (max of 90 seconds) Assistant for NRF-I: $50/run (max of 90 seconds)
Critical Point Drying NRF-A:$10/use (up to 10 samples) NRF-I:$25/use (up to 10 samples) Assistant for NRF-A: $20/use (up to 10 samples) Assistant for NRF-I: $50/use (up to 10 samples)	

Particle Synthesis and Characterization	
Nanoparticle Synthesis: NRF-A:$20/hr NRF-I:$40/hr Assistant for NRF-A: $60/hour Assistant for NRF-I: $100/hour	**Atlas Automated Batch Chemisty System:** NRF-A:$20/hr NRF-I:$40/hr Assistant for NRF-A: $60/hour Assistant for NRF-I: $100/hour
Malvern Zetasizer DLS NRF-A:$5/hr (R) and $5/hr (O) NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour	**Cary 50 Bio UV-Vis** NRF-A:$5/hr (R) and $5/hr (O) NRF-I:$10/hr Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour
TSI Particle Image Velocimeter NRF-A:$15/hr (R) and $5/hr (O) NRF-I:$60/hr Assistant for NRF-A: $60/hour Assistant for NRF-I: $100/hour	**Mice Chamber for Particle Exposure** NRF-A:$5/day NRF-I:$15/day Assistant for NRF-A: $40/hour Assistant for NRF-I: $100/hour

Jens Molecular and Nanoscale Analysis Laboratory	
Agilent ICP-MS 7500 ce: WUSTL EECE:$15/hr WUSTL non-EECE: $30/hr External:$50/hr	**Quantachrome BET:** WUSTL EECE:$15/hr WUSTL non-EECE: $30/hr External:$50/hr

Agilent G1701DA GC-MS: WUSTL EECE:$15/hr WUSTL non-EECE: $30/hr External:$50/hr	**Nicolette Nexus 470 FTIR:** WUSTL EECE:$15/hr WUSTL non-EECE: $30/hr External:$50/hr
TA Instruments Q5000 IR TGA: WUSTL EECE:$15/hr WUSTL non-EECE: $30/hr External:$50/hr	**Shimadzu TOC-LCPH:** WUSTL EECE:$15/hr WUSTL non-EECE: $30/hr External:$50/hr

For WUSTL users only: The laboratory manager should be informed of changes in account number and supervisor, as all charges are made to the supervisor's account number. If your department provides NNIN-WUSTL with a replacement account number, we will adopt it. It is important to use current, accurate account numbers at all times to avoid bounced charges and unnecessary bookkeeping. If you wish to be charged to multiple accounts, please notify the laboratory manager, so special arrangements can be made.

2.4 Equipment Scheduling

Users can reserve available time for use of instrument through our online scheduling system NRF-FOM. Users have to sign up in advance, but cannot reserve the instrument over 21 days in advance. **Failure to cancel an unneeded reservation results in inefficient utilization of resources, which is subject to a charge equal to one hour of instrument usage.**

Users who need to get assistance from staff members have priority for system access during the normal working day (9:00 a. m. to 5:00 p.m.). This priority does not extend into the evenings or weekends. This, however, is not an excuse for indiscriminate bumping of scheduled users except in an extreme emergency situation. Please DO NOT sign up for more than FOUR hours per day during regular hours, leaving more slots for other users.

Users are encouraged to schedule with a staff member as much as one week in advance if assistance is needed in the use of any instrument. It is the responsibility of the users to initiate such scheduling. All scheduled users need to coordinate with the laboratory manager to avoid conflict with resources. Priority access is provided for WUSTL users and industrial partners who have been regular users for more than a year at the facility. Under any circumstances, the laboratory manager has the right to schedule the use of the lab accordingly.

2.6 Problems

Problems due to equipment malfunctions and breakage should be reported to the laboratory manager. **Do not try to fix or adjust anything by yourself.** The equipment is very expensive and much of it is very delicate. Considerable damage can be done at a great cost of both money and downtime by well-meaning attempts to fix damages. There is no reason for any user to use a tool on anything, with the exception of a small screwdriver or Allen wrench for sample mounting. **If users misuse the equipment by not consulting the staff members or by**

disregarding the suggestions provided by the staff members, users are responsible for any damage(s).

Do not call the staff at home in the evenings or on weekends about minor problems with the equipment or your process. It will have to wait until the next business morning. Obviously, major problems such as fire, smoke, or equipment alarms should be reported immediately. If you have any doubt, call the laboratory manager first. Any emergency involving injuries, fire, chemical spills, etcetera, should be reported to WUSTL Environmental Health and Safety (EH&S) group. The phone number for EH&S is posted in the laboratory.

3. Laboratory Practice

3.1 Visitors

Users are discouraged from taking casual visitors for tours in the facility. A "visitor" is anyone without a key specifically issued to him/her. The laboratory manager needs to schedule a tour in advance for any individual visitors. Users are discouraged to bring visitors during training, qualified, or warm-up sessions, respectively. NRF staff has the authority to request that unapproved visitors leave the lab.

3.2. User Storage

The laboratory manager may assign a limited amount of storage space to users of the facility. Typically, one drawer is allocated per research group for users. Storage space should be used for keeping samples. No chemicals of any kind may be stored in these drawers. Chemicals are to be stored only in the special ventilated chemical cabinets. Private stocks of glassware are not to be kept in the drawers. Please use your storage space wisely or it will be given to someone else. Do not put your stuff in a drawer that was not assigned to you. **Be sure to follow EHS protocols when labeling things (name, date, chemical contents, hazards).** The staff periodically disposes of things left in unassigned drawers, as well as things labeled as belonging to non-active graduated students and research groups. See the laboratory manager for the drawer space allocations. No additional dry boxes, desiccators, cabinets, etcetera, may be left in the laboratory without permission.

3.3. Phones

Phones are provided throughout the laboratory for the use of staff and users. To place a call off-campus, you must dial nine (9). Long distance calls may not be made without an access code. The facility phones are not a substitute for office phones for WUSTL users. Users should not routinely make or receive calls in the laboratory. The facility will not routinely take messages for users.

3.4. Computers

Computers are available to staff and users for data analysis and other research activities. Users are encouraged to backup their data files to a Flash Drive from computer hard drives. The laboratory manager and staff will periodically delete old data files. Installation of any application software or system changes on the computers must be approved in advance by the laboratory manager.

4. Reporting Requirements and Intellectual Property

4.1 Acknowledgements

The Nano Research Facility (NRF) and the National Nanotechnology Infrastructure Network (NNIN) should be acknowledged in any publication resulting from work done in whole or in part using NRF facilities, staff or other resources. This is an important aspect of NRF's participation in the NNIN. The National Science Foundation is interested in the results of the good work being done using NNIN facilities. Ultimately, the author(s) of the paper can word the acknowledgement as they choose, but below is the recommended acknowledgement, particularly for peer-reviewed journal publications:

> This work was performed in part at the Nano Research Facility (NRF), a member of the National Nanotechnology Infrastructure Network (NNIN), which is supported by the National Science Foundation under Grant No. ECS-0335765. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. NRF is part of the School of Engineering and Applied Science at Washington University in St. Louis.

For presentations and posters, just listing the Nano Research Facility (NRF) is sufficient. However, if the NNIN and NSF can be included without causing space issues, that would be preferred.

If you wish to use a NRF logo on your presentation or poster, please email us at NRF-NNIN@wustl.edu. Simply state what the logo will be used on and how it will be used.

4.2 Reporting

The Nano Research Facility (NRF) is required to provide information about publications, conference presentation and posters, patents, book chapters, etc… that result from work conducted in whole or in part at the facility to NSF-NNIN on a yearly basis. NRF also is required to provide short descriptions of the various projects being conducted at the facility to NSF-NNIN on a yearly basis. This information is not publicized and is used by NSF-NNIN to evaluate the effectiveness of NRF. NRF asks users to provide a list of publications and project updates at

least once a year. If there are any intellectual property concerns with reporting of project information please email us at NRF-NNIN@wustl.edu.

4.3 Intellectual Property

NRF employs a flexible policy which protects the intellectual property of our users. **The Intellectual Property Policy of NRF is simple: Washington University does not make any claim on your intellectual property based solely on your use of NRF.** Effectively, you are merely renting equipment time in NRF.

NRF operates as a user facility, therefore, under normal conditions work in our facility is done by your people using your ideas. NRF provides access to equipment, and NRF staff will normally provide only equipment instruction and general process support for common open processes. Users need not tell us the details of their processes, design, or process integration, and they need not ask for our assistance in developing intellectual property. Most industrial projects bring their own skilled scientists to work in our laboratory so little high level technical interaction is required. **In short, as long as you seek only general equipment and process instruction your intellectual property is clear.**

That being said, if you choose to disclose confidential information to NRF staff or other users you should have no expectation of continued confidentiality. If you ask for NRF staff assistance in solving a specific problem and that interaction results in new intellectual property, NRF may have partial claim to that property, as you would expect. This, however, rarely happens and does not happen by accident. (For information regarding Research Collaboration Agreements with NRF email us at NRF-NNIN@wustl.edu.)

Note: if you seek the academic expertise and process knowledge of Washington University in St. Louis faculty and grad students, you should consider the sponsored research mode described below. Companies may establish a sponsored research program with any Washington University to gain access to that faculty member’s (and his students') unique expertise. Here the intellectual center and drive for the project centers with the faculty member not with the sponsor. This is typically a longer term interaction that does not involve deliverables. These arrangements and the disposition of intellectual property are between the company and the faculty member. NRF has essentially no part in these arrangements; they are mentioned here only as it is the common and only mode at other universities and facilities.