NRRPT® NEWS

National Registry of Radiation Protection Technologists

Summer 2010 Edition

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INSIDE THIS ISSUE

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Chairman's Message

Dave Biela

For this news article, I was going insert a chart of all the schools that had any nuclear type programs, 2 year, 4 years, certificate, anything. Pleasantly it just became too extensive. I say pleasantly because there are opportunities all over the United States, in just about every State, to advance the education and training of the technician work force. With computers everywhere, it is simple to find all types of programs in your area by typing in the State you live in and writing in things like; “Nuclear Engineering”; Health Physics Degrees. Recently our facility hired several technicians from some of the two-year programs. These individuals had their degree and some field experience working outages and they are working out fine. I encourage all of you that have not done so yet, to take advantage of the many programs out there to advance your education.

I recently attended the 74th Board meeting, which was in Salt Lake City, UT. One of the big items on the agenda was the visit by the American Council on Education “ACE” re-accreditation committee. Every three years ACE has to verify that we are staying compliant with all the requirements needed to keep the credit recommendation for the NRRPT exam. Over the last three years the ACE process has changed dramatically. I want to thank Kelli Gallion for all the work she did to prepare us for this review.

As most of you know by now, that last year we received a grant of $10,000/year for five years from Cabrera Services to be used for

scholarships. So far we have received very few requests for assistance. If you are going to school in a nuclear related field and need assistance with the cost of tuition or books, go on line to www.NRRPT.org and apply for assistance.

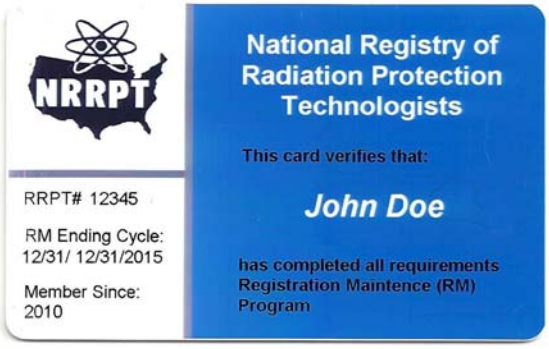
I want to end this by asking everyone to give back to the profession. If you currently know technicians that have been in the profession for at least 5 years and have not yet sat for the NRRPT exam, I ask you to not only encourage them to sit for the February 26, 2011 exam, but also help them to prepare for it. After 24 years, I still remember the individuals that went out of their way to help me prepare for my exam in 1986. The individuals that you help today may be in a position to help you in the future. I hope you are having a very enjoyable summer.

Sincerely,
Dave Biela
NRRPT, Chairman of the Board

NRRPT Membership Card

With the registration maintenance program in full swing and most of the wrinkles ironed out or at least reasonably flat, it is time to better support you by providing documentation other than an e-mail response notifying you that your status as a RRPT has been properly maintained.

Some of you may have already received your evidence of completion in the form of a nicely done card that will fit in your wallet or purse card holder. This should make it easier for you if your current or prospective employer wishes to see documented evidence that you are in fact registered and in good standing by maintaining your registration.



If you have not received your card yet, but have submitted your registration maintenance package, don't despair, you will receive it shortly. If you are not due for registration maintenance for a while yet, feel free to contact the Executive Secretary at nrrpt@nrrpt.org or by telephone at (401) 637-4811 if you must have documented confirmation of your registration status.

NRRPT Finances

By Barry Kimray - Secretary/Treasurer

The finances of the NRRPT are sound for our current economy.

We established an investment account several years ago to fund non-routine expenses like our ACE credit recommendation (college credits for passing exam) and trademark renewals (NRRPT initials and logo). We have expanded the mission of the investment account to have funds available for at least one year's operating expenses for the NRRPT organization. Thus, we would like to have about $205,000 in our investment account. We had $153,492.86 on 12/31/09 after a gain of $27,803.26 or 21.95% for the 2009. Our account was hit hard in 2008 by the overall market decline as were all of our 401Ks and investments.

The finances of the Registry are audited at least every three years and upon change of the Secretary/Treasurer. The 2009 scheduled audit was completed on June 30, 2009. The audit indicated that the assets of the Registry declined by $10,589 during 2008. This decline was caused by a loss of $23,916 in our investments which was partially offset by revenues ($8,551) and interest and dividends ($4,776).

For 2009, we ended with a surplus of $25,788 in our budget which we will carry forward to 2010. We had an income of $205,831 compared with a budget of $221,284. Our expenses were $180,042 compared with a budget of $221,081. We had fewer technicians taking the exam than in the past and we lost a few corporate sponsors due to the economy.

Our initial 2010 budget was developed based on our 2009 experience. We have an initial 2010 projected deficit of $5,987 based on income and expense projections. We anticipate income of $182,288 and expenses of $188,725.

Details are:

- Decrease in corporate sponsors.
- Reduction in the number of exam registrations.
- ACE Credit Recommendation costs of $10,000.
- Decrease in Award committees' budget due to funding NRRPT scholarships from the Cabrera Scholarship fund.

If deficit remains at our summer meeting, up to $10,000 (ACE) will be withdrawn from the investment account to fund 2010 budget needs. Funding of ACE costs was one of the primary reasons for establishing the investment account. Thus, this withdrawal is not outside the mission of the investment account. However, we envision gaining a couple new corporate sponsors which hopefully will cover our 2010 budget needs without withdrawing from our investment account.

On a positive note, the new Cabrera Scholarship had greatly increased the Registry's funding for scholarships. We have established separate accounts for the Cabrera Scholarship to fund all the Registry's scholarships. This tremendous gesture has reduced the funding needs of the Awards committee in our budget. We urge every registrant to take advantage of the Registry's scholarship opportunities to improve your selves.

Testing, testing...

By Todd Davidson

Welcome again to the feature "Testing, testing." As stated previously, this feature will present test questions as well as general test-taking strategies and advice. If you find value in these questions and solutions, please share them with other workers in the field who have not passed the NRRPT test. The advice that is given in this feature can be used for any standardized test that is given, particularly those that are based in radiation protection.

Problem:

Given a broad beam source of radiation with a dose rate of 50 R/h at one foot, a shield that is 7.5 half-value layers thick, and the dose rate of 1500 mR/h on the opposite side of the shield, what is the buildup factor?

Solution:

Begin by using the equation for broad-beam conditions.

$$I = BI_0e^{-\mu x}$$

Where

I is the intensity (dose rate) after the shielding

I0 is the original intensity (dose rate) prior to the shield

B is the buildup factor

μ is the linear attenuation coefficient

x is the thickness of the shield.

Notice that there is no specific data for μ and x. Therefore look to the value of the number of half-value layers (HVLs) that is specified. Note that if the value of HVLs is listed, this is analogous to stating the number of half-lives. That is the number of half-lives is equal to the decay constant, ë, times the elapsed time, t. Similarly, the number of HVLs is equal to μ times x.

$$I = BI_0e^{-HVL}$$

$$B = \frac{I}{I_0e^{-HVL}}_0$$

$$B = \frac{1.5\ R/h}{50\ R/h\ \ e^{-7.5}}_0$$

$$B = 54.2$$

Note that this problem is fairly straightforward and closely follows mathematical form for half-life calculations. There are more difficult, iterative solutions that involve buildup factors, particularly when there is more than one unknown. These more difficult problems would be unlikely to appear on a test where there is an average of 1 1/3 minute per problem.

On another note, many of the current practicioners may be willing to sit for the ABHP examination. The first part of the examination is very similar to the NRRPT. They are both 150 questions. Both tests have multiple choice answers. Both tests draw upon similar sources for their bank of questions.

The second part of the ABHP examination is much different. The questions are longer, they are weighted differently, and they require both essay-type answers as well as in-depth knowledge of the concepts and equations. There are two types of questions on the second part of the ABHP exam. Questions 1 through 6 are multi-part questions that

are worth 50 points each. All six of these questions must be answered. Questions 7 through 14 are multi-part questions that are worth 100 points each. Out of these eight questions, the candidates must chose four to answer.

It is the strong opinion of the author that candidates should begin the test by ignoring the 50 point questions and should concentrate on choosing the 100 point questions to answer. Then they should begin answering the 100 point questions. Only after the 100 point questions are complete (or nearly so) should the candidate even look at the 50 point questions.

The reason for the listed strategy follows. There is a total of 700 possible points on the test. Generally, although the passing rate is variable, the pass rate is somewhere around 60 to 70%. If we assume that the passing rate is 70%, that means that a score of 490 or better must be achieved. If a candidate scores an average of 80% on each of the 100 point questions, the score would be 360 without the benefit of the 50 point questions. The candidate would only need to make an average of 43.3% on each of the 50 point questions, or 21.7 points.

If you start with the longer, more cumbersome questions, you will be able to better gauge your time on each question. It is much easier to adjust your test management without much time remaining for 50 point questions than it is to adjust for 100 point questions.

Professional Pool

By Todd Davidson

In this feature, the author will present ideas and solutions to practical problems that face professionals in the field of radiological protection and science. Generally, questions that have been presented to the board and panel will be shared with the readers. At times, the particular solutions from various responders will be included as well.

Problem

At a site, the RCTs are required to record the value of the high voltage as part of the daily operational check. For Ludlum model 3's and 12's, the high voltage is graduated in 0.1 kV (100 V) increments, however the control tolerance that is used is ± 10 V from the nominal calibration level (900 V).

Solution

The following solution was sent to the author by Joanne Glenn. She will get a NRRPT shirt for her participation in this article.

I commend the checking of the HV in the daily check, especially for plateaued probes. Some plateaued probes, such as Ludlum's 43-93's, 43-89's, and 43-5's are voltage sensitive. I recommend marrying meters and probes for this reason. This is a longer discussion.
However, there is a solution to the problem. It can be handled pretty simply.

- *The HV check on a Ludlum Model 3 should be N/A. There is no external HV check button on them.*
- *#2: I also suggest revising the procedure to accommodate for the use of analog meters. 10V is impossible to see with the eye accurately. The procedure was probably written at a time when the Model 2221, which has a digital readout, was used. Since the question uses a "nominal calibration level" of 900V, I am assuming they are using a pancake probe, which the manufacturer's operating voltage is 850-1000V, recommended voltage 900V. I would change the procedure to read the following steps.*

Continued on page 19

Charles D. (Bama) McKnight Memorial Award Presented to Mike Davidson

The Charles D. (Bama) McKnight Memorial Award was established in honor of "Bama" because of his significant contributions to the NRRPT. "Bama" was one of the Registry's great Pioneers as well as an exceptional Instructor/ Teacher, one that you never forgot. "Bama" had the gift of making the technically difficult understandable and enjoyable.

This award is presented to persons who have given outstanding efforts in the radiation protection training field leading to increased knowledge and professionalism among Radiation Protection Technologists. The Awards Committee is chartered to deliberate on potential nominees for this recognition annually; however, the frequency of this award is at the sole discretion of the Board. Without any hesitation this is one of our highest awards we can bestow any individual. To be considered for this award the recipient must have demonstrated an outstanding effort in the field of radiation protection training.

We (the Board) are very please to present the Charles D. (Bama) McKnight Memorial Award to Mr. Mike Davidson from Tidewater Ches-Nuc. Mike has been a member of the NRRPT since 1987 and a strong supporter for many years. Mike's outstanding contribution to the NRRPT comes in the form of a preparation course. Over 1000 candidates have taken Mike's course, with over 80% passing the exam. Mike has a degree in education and therefore his teaching style and training is advantageous to our adult population preparing for the exam. Mike's dedication and professionalism in training health physics students has helped a large number of NRRPT candidates stay focused with their training, excel in the classroom and ultimately become successful NRRPT registered members.

From the entire NRRPT organization, we congratulate Mr. Davidson for his commitment to the radiation protection training field.

A General Review of Health Physics Calculations

By Augustinus Ong

The purpose of this review, in the format of questions and answers, is to remind ourselves of some of the basic aspects of health physics calculations.

(1) A sample of an unknown radioactive material contains 10^6 radioactive nuclei (N_o). The half-life ($T_{1/2}$) is 1 min. How many nuclei, N(t), remain after 0.5 min (t)?

$N(t) = N_o\, e^{-\lambda t}$

$N(t = 0.5 \text{ min}) = 10^6\, e^{-(0.693 / 1 \text{ min})(0.5 \text{ min})}$

Where $\lambda = \ln 2 / T_{1/2} = 0.693 / T_{1/2}$

$N(t = 0.5 \text{ min}) = 0.707 \times 10^6$

(2) A sample of an unknown radioactive material is exposed to a beam of neutrons that is absorbed at a rate of 10^6 (μ). The daughter product of this interaction emits beta particles with a half-life of 2.7 days (τ). How many daughter atoms, N(t), are present after 3 days (t) of continuous neutron bombardment?

We will use the equation for continuous irradiation of target that produces decaying daughter atoms:

$N(t) = [\mu / \lambda \times [\, 1 - e^{(-\lambda t)}\,]$

$N(t) = [\mu\, (\tau / \ln 2)] \times [\, 1 - e^{(-\ln 2 / \tau)(t)}\,]$

$N(t) = [\, (10^6 / \text{sec}) \times 2.7 \text{ days} / 0.693\,] \times [\, 1 - e^{(-0.693 / 2.7 \text{ days})(3 \text{ days})}\,]$

$N(t) = [\, (10^6 / \text{sec}) \times 86{,}400 \text{ sec} / 0.693\,] \times [\, 1 - e^{(-0.693 / 2.7 \text{ days})(3 \text{ days})}\,]$

$N(t) = [1.25 \times 10^{11}] \times [0.537]$

$N(t) = 6.71 \times 10^{10}$ atoms

(3) At a research facility, the maximum permissible dose for radiation workers using a gamma-emitter source is 5 mR/hr. What is the safe working distance from an old Cs-137 source that has a dose rate of 2 R/hr at a distance of r_o = 1 m. If the source is shielded which reduces the gamma radiation to 1%, how close can a researcher work near the source without exceeding the maximum permissible dose? For this problem, air attenuation of radiation can be neglected.

We will use the ratio of inverse square law:

$I(r) / I(r_o) = r_o^2 / r^2$

Where Intensities, $I(r) = 5$ mR/hr and $I(r_o) = 2$ R/hr

$r^2 = [I(r_o)](r_o^2) / I(r)$

$r = \sqrt{\{[I(r_o)](r_o^2) / I(r)\}}$

$r = r_o \sqrt{\{[I(r_o)] / I(r)\}}$

$r = (1\text{ m}) \sqrt{[(2\text{ R/hr}) / (0.005\text{ R/hr})]}$

$r = 20$ m

If the shield reduces the radiation to 1% of its unshielded emission, then by using the following equation:

$r_1 = r_o \sqrt{\{[I(r_o)] / I(r)\}}$

$r_1 = (1\text{ m}) \sqrt{[(0.02\text{ R/hr}) / (0.005\text{ R/hr})]}$

$r_1 = 4$ m

(4) A slab of aluminum alloy 50 cm thick attenuates gamma radiation from a source to 1% of its original intensity at 1 m. The density, ρ, of aluminum alloy is 4.50 g / cm^3. What is the mass absorption coefficient and linear cross section for this interaction?

We will use the following linear attenuation equation to solve for the linear cross section:

$I = I_o e^{-\mu x}$

Where μ is the linear absorption coefficient, I_o is the incident intensity.
$\mu = (-1 / x) \ln (I / I_o)$

Let $I(50\text{ cm}) = 1\%$ of $I_o = 0.01\ I_o$

$\mu = (-1 / 50\text{ cm}) \ln (0.001\ I_o / I_o)$

$\mu = (-1 / 50\text{ cm}) \ln (0.001)$

$\mu = 0.1382\text{ cm}^{-1}$

To solve for the mass absorption coefficient, μ_m:

$\mu_m = \mu / \rho$

$\mu_m = 0.1382\text{ cm}^{-1} / 4.50\text{ g / cm}^3$

$\mu_m = 0.0307\ cm^2\text{-}g^{-1}$

(5) If a nuclear reactor delivers 20 MW of continuous heat, how many U-235 fission events, n, must occur per second to produce this heat energy? The amount of energy, E, released per fission event is approx. 200 MeV.

$E = (2.0 \times 10^8\ eV) \times (1.6 \times 10^{-19}\ J/eV)$

$E = 3.2 \times 10^{-11}\ J$

Then solving for n, the total number of nuclei undergoing fission per second to produce 2×10^7 J/sec of power is:

n = power / energy per fission

$n = 2 \times 10^7\ J/sec / 3.2 \times 10^{-11}\ J$

$n = 6.25 \times 10^{17}$ nuclei per sec

(6) K-42 is produced by the reaction, $^{41}K(n, \gamma)\ ^{42}K$. In the environment, potassium is composed of 7% ^{41}K and 93% ^{39}K. What is the activation rate of ^{42}K per gram of K that is bombarded with thermal neutrons with a flux density, ϕ, of 10^{15} neutrons / cm^2-sec? The neutron capture cross section, σ, of ^{41}K is 1.2 barns.

Atomic weight, AW, of ^{41}K is approx. 41.

We will use the following approximation activation rate, R, per unit mass of target material:

$R \cong [(6.023 \times 10^{23}) \times \sigma \times \phi] / AW$

$R \cong [(6.023 \times 10^{23}) \times (1.2 \times 10^{-24}) \times (10^{15}\ neutrons / cm^2\text{-}sec)] / 41$

$R \cong 1.76 \times 10^{13}$ activations / g (^{41}K) sec

Since the activation rate per gram of K is 7%, thus

$R \cong 0.07 \times 1.76 \times 10^{13}$ activations / g (^{41}K) sec

$R \cong 1.23 \times 10^{13}$ activations / g (K) sec

Interview With A Chairman

By Todd Davidson

The National Registry of Radiation Protection Technologists (NRRPT) has been around for almost 35 years, and most of the registrants do not know its developmental history. The following is a personal interview with the original Chairman of the NRRPT Board of Directors, Don Marshall.

NRRPT: What was the impetus for the formation of the National Registry of Radiation Protection Technologists?

Don: In 1973, John Oran (a member of the Board of Directors for the American Board of Health Physicists [ABHP]) approached three individuals and asked that they evaluate the necessity and viability of certification for technologists in the field of radiation protection. Me (I was at INL), Ronnie Kitts (Tennessee Valley Authority – Chattanooga), and Ralph Jeffers (Oak Ridge National Laboratory) got together to perform that task. The individuals decided that it was necessary, possible, and viable.

NRRPT: So how did you start from nothing but an idea to get to an organization that people found it valuable to join?

Don: The next Health Physics Society (HPS) meeting (I believe it was in Denver), I was assigned as the straw man by the ABHP. Between the two meetings the individuals were working on various projects to get the organization off the ground. I was working on the by-laws of the organization. Ronnie was working on incorporation as a non-profit organization. Ace Butler (Oak Ridge National Lab) who replaced Ralph Jeffers worked on finding a database of test questions. At the meeting, we contacted all of the local chapters of the HPS and requested nominations for members of the NRRPT board of directors and panel of examiners. We got a lot of very qualified individuals.

At a meeting in November of that year in Rockville, MD, we chose eight members of the board and ten to twelve members of the panel. I was elected as chairman of the board, Ronnie was elected as vice-chair, and Chuck Costa was elected as Secretary. Arthur Humm was elected/chosen as the first exam panel chairman.

NRRPT: Eventually you formed an organization and administered a test, what did it take to get to that milestone?

Don Marshall (first Chairman of the Board) and Todd Davidson

Don: The test questions were made and heavily borrowed from a test bank from certification tests for radiologists. We had to discuss and debate the passing point, and we had to perform edits on the by-laws. We had decided that the members of the Board and Panel would be grandfathered in to the organization, because we were the ones generating the examination.

We had a great challenge facing us at the beginning, we had no money. Therefore, in order to print a test, we chose to charge all members of the board and panel $40, even though they were grandfathered and were not required to pass the test. With that bit of capital, and a lot of facilities donating locations to take the examination and professionals to proctor the examination, we administered the first test. The results of the first test were that 83 people sat for the exam, and 62 passed.

NRRPT: Any other specifics about the organization that you want to point out?

Don: Well, we were very lucky as an organization because we had the right people in the right position at the right time. For example, at the time when we needed to grow the organization and needed someone with good business sense, Paul Lovendale was elected as chairman. His expertise in this area was essential to the organization.

There have been several other organizations through the years that have sprung up to compete with the NRRPT, and we're still going strong, and they've gone by the wayside.

NRRPT: What were your greatest challenges in those early days of formation?

Don: I already mentioned two of them. The by-laws were fairly difficult, although I had a lot of support from Rice Rich and Mike Terpilak.

It was also very difficult to incorporate as a non-profit organization.

NRRPT: Describe the NRRPT in ten words or less.

Don: Program of strength, character, and credibility that qualifies radiological technologists.

NRRPT: What has changed most about the organization since its beginning?

Don: The electronic opportunities are greater. In the beginning it was much more difficult for a large organization to communicate across the country.

The organization is more in-tune with the needs of the industry now.

NRRPT: You were able to see some of the test bank questions and join in our discussions on the exam panel. What has changed, if anything, about the test questions?

Don: The questions are more difficult. However, the ability to get study material is more available. This is because of people like Dr. Gollnick who made a text specifically for technicians and technologists.

NRRPT: What would you say are the biggest challenges facing the industry today and into the future?

Don: It is difficult to ensure public safety and to ensure the public that they are safe. We are in the middle of a turnover of public opinion on nuclear power, and we have to make sure that they understand that this is a safe industry.

And always when there is technology, we must continue to make it better and safer. We need to ensure that our pursuit of knowledge in this field continues.

It is not possible or practical to identify personally all of the individuals and agencies who worked so hard and diligently to develop the program that we have today starting from the meager roots described above. To those of you that worked so diligently to start the NRRPT who were not mentioned and to those of you who maintain this legacy you have the sincere thanks and gratitude of the NRRPT and each current and past member of the Board of Directors and the Panel of Examiners. Ed.

NRRPT Night-Out in Salt Lake City, UT

The NRRPT "Night-Out" has become a tradition for Board & Panel members and family & friends of the Registry. Over 30 people attended the dinner and awards ceremony in Salt Lake City, UT. This tradition continues due to the generous contributions of our "Night-Out" sponsors and supporters.
Many, many thanks to them!!

The "Group"

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GEL provides the nuclear industry with radiochemistry, bioassay and analytical chemistry support. GEL is a provider of 10CFR61, REMP and hazardous waste characterization to commercial nuclear reactor sites, DOE sites and DOD facilities throughout the US. For information regarding analytical services please contact Bob Wills.

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Continued from page 8

- *"Denote the HV on the daily check sheet. Complete the source check to verify that the meter fell into its pre-determined range (to prove the instrument was still working properly at the end of the last use or not)."*
- *"Adjust, if necessary, and denote any changes in the comment section."*
- *"Perform and denote another source check."*

- *Or you can change the procedure to allow a range of "± 25V."*

Adjusting the HV under the calibration cover does not recalibrate the HV on a Model 12, it adjusts it. Ensure the scale pots and discriminator are **not** *adjusted, as they do affect the calibration.*

Ultimately, the daily check is there to provide data that the meter was working properly before and after use. If the HV was off by too much, the source check would indicate this. That is especially true if a ± 10% error range is used on the source check instead of a ± 20% error range.

If you have any other problems and/or solutions that you would like to be included in this forum, please feel free to contact me at t-davidson@sbcglobal.net.

Welcome New Members

Congratulations to the following individuals who successfully passed the NRRPT February 20, 2010 examination:

Richard F. Charles
David J. Deal
Robert L. Doyon
James P. Elliott
James A. Franz
Bryce C. Hillman
Sam P. Hobbs
James G. Kauffman
Steven P. King
Michael P. LaBanc
Brandon W. Little
Douglas A. Lohafer
Kenneth W. McLain
Manuel Mejias
Charles H. Smith
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Charles A. Taylor
Troy B. Terry
Justin W. Trenidad
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New Members: If you do not have access to the "Members Only" portion of the website, please contact the Executive Secretary (nrrpt@nrrpt.org). Your email address must be on file in order for you to gain access.

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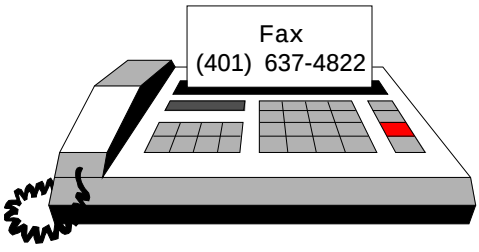

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