From: Brian Magnuson
To: Smith, Micheal
Cc: Blumberg, Mark; Meighan, Sean
Subject: [External_Sender] Regulatory Guide 1.183 Revision Public Meeting - Magnuson Comments
Date: Tuesday, December 08, 2020 10:09:56 PM

December 8, 2020

Micheal:

My RG 1.183 Public Meeting comments are inserted (**bold font**) in the NRC's presentation below.

Please send the ML# when they are placed in ADAMS.

Thank you,
Brian

RG 1.183 Public Meeting November 19, 2020 – Brian Magnuson Comments

The NRC staff has restarted efforts to revise RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors."

> **DG-1199 (Draft RG 1.183 Revision 1) was the first effort to revise RG 1.183. It was prompted by SAND2008-6601 and published by the NRC in 2009; however, it was never implemented. After eleven years, what prompted this effort?**

incorporate relevant operating experience as well as recent post-Fukushima seismic risk insights and walkdowns;

> **As important, are the accident source terms insights from Fukushima that were incorporated into RASCAL 4 (NUREG-1430, September 2012) source terms and methodologies. Will these insights be incorporated into RG 1.183-Revision 1?**
>
> **Why is the revision to RG 1.183 lagging behind revisions to RASCAL?**

ensure sufficient guidance is in place for licensing advanced light-water reactors (LWRs), accident tolerant fuel (ATF), high-burnup, and increased enrichment fuel; and,

> **NUREG-1465 (1995) "Accident Source Terms for Light-Water Nuclear Power Plants":**
>
> > ***"Recent information has indicated that high burnup fuel, that is, fuel irradiated at levels in excess of about 40 GWD/MTU, may be more prone***

to failure during design basis reactivity insertion accidents (RIA) than previously thought. Preliminary indications are that high burnup fuel also may be in a highly fragmented or powdered form, so that failure of the cladding could result in a significant fraction of the fuel itself being released."

The underlying concern identified here, is a cladding failure source term release could exceed that of a fuel melt source term release. What should be considered in RG 1.183-Revision 1, is the radiological consequences of a lessor and more likely accident may be worse than the "maximum credible accident" assumed in licensees' current licensing bases.

Reports and studies (e.g., Resolution of Generic Safety Issues: Issue 170: Fuel Damage Criteria for High Burnup Fuel (Rev. 2)) have evaluated high-burnup fuel and approved higher burn-up levels, but they have neither disputed the fuel disintegration caused by high-burnup nor evaluated the consequences of a powdered fuel source term. Until this NUREG-1465 concern has been eliminated, any revision to RG 1.183 should include a powdered fuel source term.

Limited range of applicability on Non-LOCA release fractions

Notably, DG-1199 significantly increased Non-LOCA nobel gas release fractions (above RG 1.183 Revision 0) and returned them to NUREG-1465 levels.

Excessive MISV leakage rates and realizations from the TMI accident prompted control room habitability studies and modifications to install Control Room Emergency Ventilation/Filter Systems. Subsequently, RG 1.183-Revision 0 required Control Room Operator doses to be evaluated for specific accidents, including the Non-LOCA fuel handling accident (FHA); however, missing from RG 1.183-Revision 0 is a requirement to evaluate doses to those workers/fuel handlers that would be in close proximity to this accident. Given the concerns identified in NRC Information Notice No. 90-08: "*KR-85 Hazards From Decayed Fuel*" and estimations based on FHA doses to control room operators, workers near spent fuel pools during would undoubtedly be overexposed (> 5 Rem TEDE).

Because no amount of water in spent fuel pools will not prevent the release of nobel gas (Kr-85, a pure beta emitter) in a FHA, revisions to RG 1.183 should require the calculation of spent fuel pool doses to ensure workers are aware of the hazards. This calculation could also be used to ensure the viability of FLEX actions to intended to mitigate an extended loss of spent fuel pool cooling.

DG-1199

In October 2009, the NRC issued for public comment DG-1199 as a proposed Rev. 1 of RG 1.183.

Staff received 150 public comments

The reasons for revision of RG 1.183 in DG-1199 were:

Providing additional guidance for modeling BWR MSIV leakage,

> **SAND2008-6601 determined RG 1.183 BWR MSIV leakage source terms and methodologies are "non-conservative and conceptually in error." These conceptual errors (and others) should be corrected in any revision to RG 1.183.**

2019 License Amendment Requests

In 2019, NRC received several AST LARs requesting increased MSIV leakage
As a result, work on DG-1199 was postponed to allow NRC staff to incorporate lessons learned, from evaluation of the LARs, into the revised RG 1.183:

James A. FitzPatrick Amendment No. 338 for AST, July 21, 2020 (ML20140A070)
Quad Cities Nuclear Power Station, Units 1 & 2 – Amendment Nos. 281 and 277 to increase allowable MSIV leakage, June 26, 2020 (ML20150A328)
Nine Mile Point Nuclear Station, Unit 2 – Amendment No. 182 to change allowable MSIV leak rates, October 20, 2020 (ML20241A190)
Dresden Nuclear Power Station, Units 2 & 3 – Amendments Nos. 272 and 265 to increase allowable MSIV leakage, October 23, 2020 (ML20265A240)

> **Does the NRC mean say LARs from last year (2019) cause a 11-year delay? DG-1199 (RG 1.183 Revision 1 Draft) was published by the NRC in 2009. In consideration of "The NRC Approach to Open Government," please explain the 11-year delay.**
>
> **SAND2008-6601 clearly explains/illustrates that RG 1.183 MSIV Leakage source terms and metrologies are "non-conservative and conceptually in error." Given this, why did the NRC approve the use of non-conservative and conceptually inaccurate guidance to increase MSIV leakage?**

The intent of the NRC staff is for RG 1.183 Rev. 0 and Rev. 1 to co- exist

> **With known, fundamental errors in RG 1.183-Revision 0, why would the NRC allow it to co-exist?**
>
> **The NRC's "RESULTS OF PERIODIC REVIEW OF REGULATORY GUIDE 1.183," dated June 25, 2018, states:**
>
> > ***"The known technical and regulatory issues are addressed in a draft revision to RG 1.183 issued for public comment (Draft Guide (DG)-1199, "Alternative Radiological Source Terms for Evaluating Design-Basis***

Accidents at Nuclear Power Reactors," published October 2009 (ADAMS Accession No. ML090960464)). The main technical issues are addressed in Regulatory Position (RP) 3.2, "Release Fractions," RP 5.3, "Meteorology Assumptions," and RP A-5, "Main Steam Isolation Value Leakage in Boiling Water Reactors.""

DG-1199 was prompted by SAND2008-6601, which determined RG 1.183-Revision 0 source terms and methodologies are conceptually inaccurate. The intent of DG-1199 was to correct the fundamental errors in RG 1.183-Revision 0. Is this still the intent of RG 1.183-Revision 1?

RG 1.183 states:

"The design basis accident source term is a fundamental assumption upon which a significant portion of the facility design is based."

Considering the significance of the accident source term, why would the NRC continue to allow licensees to use RG 1.183-Revision 0? Is not negligent to allow licensees to base nuclear power safety (systems) on conceptually inaccurate and non-conservative accident source terms?

Revised Fuel Handling Accident

Revisited the original studies forming the technical basis for the FHA and incorporate updated information.

Model improvements established from the current understanding of reactor fuel pin physics and iodine chemistry under the environmental conditions in which fuel handling operations are taking place.

Concluded that considerable margin exists regarding the scrubbing effects of iodine in the spent fuel or reactor pool and that the current staff DBA FHA fission product transport model can be refined while still maintaining conservatism.

Reference: Memo from RES to NRR, "Closeout to Research Assistance Request for Independent Review of Regulatory and Technical Basis for Revising the Design-basis Accident Fuel Handling Accident," November 23, 2019 (ML19270E335)

Prior to the accident at Three Mile Island (1979) and years afterward, control room operators were not protected by emergency air filtration systems. Operator doses from a DBA FHA (and other DBAs) were not publicly communicated because they exceeded General Design Criterion 19 limits (< 5 Rem whole body). After RG 1.183 was approved, the NRC required control room emergency filtration systems to be installed, and when their dose reduction factors were applied, operator doses were restored to within the

new limits of 10 CFR 50.67 (< 5 Rem TEDE). Even still, today control room operator doses are often the most limiting regulatory dose.

While there may be margin regarding the iodine doses to control room operators, there is no margin regarding the Kr-85 doses in a DBA FHA. No amount of water in spent fuel pools will mitigate or prevent the release of Kr-85 in a FHA, and nobel gasses cannot be filtered. Consideration of "*KR-85 Hazards From Decayed Fuel*" (Information Notice No. 90-08) is conspicuously missing from RG 1.183-Revision 0. Any revision RG 1.183 should address IN 90-08 concerns and require that doses to fuel handlers/workers in the area of a FHA be calculated.

Over the last 10 years no applicant or licensee has adopted the methodology from SAND2008-6601, "Analysis of Main Steam Isolation Valve Leakage in Design Basis Accident Using MELCOR 1.8.6 and RADTRAD."

There have been no communications that applicants or licensees intend to adopt the SAND2008-6601 methodology.

SAND2008-6601 is a scientific study performed by Sandia National Laboratories on behalf of the NRC that clearly explains/illustrates that RG 1.183 BWR MSIV source terms and metrologies are "non-conservative and conceptually in error." It is the technical basis for the "*proposed DG-1199 MSIV modeling changes."* Nuclear power plant owners (licensees) have not adopted SAND2008-6601 (and have resisted DG-1199) because it is unlikely that they can comply with 10 CFR 50.67 if accurate MSIV leakage models and source terms are used. Please refer to the following January 2010 letters.

January 6, 2010, Draft Regulatory Guide, DG-1199 - BWR Owners' Group Request for Supporting Documentation and Comment Period Extension (Docket ID NRC-2009-0453):

We note from our review that substantive changes are being proposed to the modeling of MSIV leakage. Leakage through the steam line pathway currently represents a significant fraction of the postulated LOCA doses in the existing DBA analysis for BWRs, including plants that credit the alternate leakage pathway via the condenser. The proposed changes in DG-1199 would have the effect of increasing the source term concentration entering the steam line by up to 20 times that of the current Regulatory Guide 1.183 methodology and assumptions. In turn, this will significantly impact the LOCA dose analysis.

January 20, 2010, Nuclear Energy Institute Comments on U.S. Nuclear Regulatory Commission Draft Regulatory Guide DG-1199, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" *(Federal Register* of October 14, 2009, 74 FR

52822).

"*It is unlikely that BWRs would commit to using it due to extreme penalties with regard to MSIV leakages* (Item 83)."

As stated in NRC's, March 22, 2010, "RESPONSE TO THE BOILING WATER REACTORS OWNER'S GROUP REQUEST TO EXTEND THE COMMENT PERIOD FOR DRAFT REGULATORY GUIDE – 1199":

"By letter dated January 6, 2010, the Boiling Water Reactor Owner's Group (BWROG) requested an extension of the public comment period for Draft Regulatory Guide – 1199 (DG-1199), "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML090960464, open from October 14, 2009, to January 13, 2010. The extension request stated that, in order to gain an understanding of the implications and potential consequences of the proposed revision, the BWROG will need to perform a detailed review of the Staff's research supporting the proposed changes to modeling of the main steam line isolation valve (MSIV) leakage."

"The Nuclear Regulatory Commission (NRC) staff has reviewed the stated basis for the request to extend the public comment period. Based upon this review, the staff has determined it will not extend the public comment period for the reasons discussed below."

"On October 9, 2010* [sic]*, the staff released the technical basis for the proposed DG-1199 MSIV modeling changes to the public in a Sandia National Laboratories Report, SAND2008-6601, "Analysis of Main Steam Isolation Valve Leakage in Design Basis Accidents Using MELCOR 1.8.6 and RADTRAD," ADAMS Accession No. ML083180196. On November 16, 2010* [sic]*, the staff held a full day public workshop that included a presentation on the proposed MSIV modeling changes, including an extensive discussion of the role of the supporting MELCOR work. Based on its review of the request by the BWROG, the staff has determined that no substantive issues with the staff's research were identified as the basis for extending the public comment period. Additionally, the staff believes that an extended period of time has been provided to provide comments on the proposed guidance."

Has the NRC disavowed SAND2008-6601?

If not, why has the NRC allowed licensees to use non-conservative and conceptually inaccurate MSIV leakage models and source terms for the past ten years?

If not, why would the NRC allow RG 1.183-Revision 0 to co-exist with RG 1.183-Revision 1?

The design basis accident source term is a fundamental assumption upon which a significant portion of every nuclear power plant design is based; therefore, RG 1.183-Revision 0 is, essentially, a generic safety issue.

The NRC's failure to act on this fundamental safety issue prompted PRM-50-122—10 CFR Part 2.802 request for rulemaking.

Additional Considerations
Consider revising footnote 7 which provides an incorrect method to convert thyroid dose to TEDE
Implies a back-of-the-envelope calculation appropriately converts between ICRP 2 and ICRP 26/30 dosimetry methodologies.
There is no simple methodology to convert between these two systems of dosimetry.
To correctly calculate the radiological dose consequences for design basis accidents the appropriate dose methodology (and DCFs) must be applied.

During the RG 1.183 public meeting on November 19, 2020, an industry member commented that the incorrect methods, described in RG 1.183, to calculate the radiological dose consequences, were used to assess Operability of structures, systems and components required by plant Technical Specifications.

Again, why would the NRC allow RG 1.183-Revision 0 to co-exist with RG 1.183-Revision 1?

From: Brian Magnuson
Sent: Saturday, December 5, 2020 3:58 PM
To: Smith, Micheal
Subject: RE: RE: Regulatory Guide 1.183 Revision Public Meeting Notice

Micheal:

I apologized for the late response.

The public meeting was informative. -Thank you.

Unfortunately, my attempts to make comments during the meeting failed for some reason. Because of this, I will revise my comments based on what I learned and resubmit them for ADAMS.

Regards,

Brian

From: Smith, Micheal
Sent: Friday, December 4, 2020 10:29 AM
To: Brian Magnuson
Subject: RE: RE: Regulatory Guide 1.183 Revision Public Meeting Notice

Brian,

I have not heard back from you so I did want to make you aware that I intend on placing your email below into ADAMS before the end of next week. I appreciate you taking the time to participate in our public meeting.

Enjoy your weekend!

Micheal Smith

Health Physicist and Assistant Radiation Safety Officer
Radiation Protection and Consequence Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-3763

From: Smith, Micheal
Sent: Thursday, November 19, 2020 4:21 PM
To: Brian Magnuson <magnuson28@msn.com>
Cc: Blumberg, Mark <Mark.Blumberg@nrc.gov>; Meighan, Sean <Sean.Meighan@nrc.gov>
Subject: RE: RE: Regulatory Guide 1.183 Revision Public Meeting Notice

Brian,

Thank you for taking the time to provide us with your questions and comments. As long as you are alright with it I plan on putting your email into ADAMS so that we can make sure we consider your questions and comments as we develop our draft guide. I will provide you the ML# once I have it.

If you have any additional questions just let us know.

Thanks,

Micheal Smith

Health Physicist and Assistant Radiation Safety Officer
Radiation Protection and Consequence Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-3763

From: Brian Magnuson <magnuson28@msn.com>
Sent: Thursday, November 19, 2020 3:25 PM
To: Smith, Micheal <Micheal.Smith@nrc.gov>
Cc: Blumberg, Mark <Mark.Blumberg@nrc.gov>; Meighan, Sean <Sean.Meighan@nrc.gov>
Subject: [External_Sender] RE: Regulatory Guide 1.183 Revision Public Meeting Notice

Micheal:

I have comments and questions.

From: Brian Magnuson
Sent: Thursday, November 19, 2020 11:55 AM
Subject: RE: Regulatory Guide 1.183 Revision Public Meeting Notice

Micheal:

I'm not sure how much time will be available today for comments; therefore, I have included some observations and questions regarding the presentation below.

Please review accordingly and let me know if you have any questions.

Thank you,
Brian

The NRC staff has restarted efforts to revise RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors."

DG-1199 (Draft RG 1.183 Revision 1) was approved (but not issued) by the NRC in 2010. After ten years, what prompted this effort?

incorporate relevant operating experience as well as recent post-Fukushima seismic risk insights and walkdowns;

Insights from Fukushima were previously incorporated into RASCAL (NUREG-1430) source terms and methodologies. Will these same insights be incorporated into RG 1.183 Revision 1? Why is the revision to RG 1.183 lagging behind revisions to RASCAL? Also, please explain why RASCAL does not use RG 1.183 source terms and methodologies.

ensure sufficient guidance is in place for licensing advanced light-water reactors (LWRs), accident tolerant fuel (ATF), high-burnup, and increased enrichment fuel; and,

NUREG-1465 (1995) "Accident Source Terms for Light-Water Nuclear Power Plants":

"Recent information has indicated that high burnup fuel, that is, fuel irradiated at levels in excess of about 40 GWD/MTU, may be more prone to failure during design basis reactivity insertion accidents (RIA) than previously thought. Preliminary indications are that high burnup fuel also may be in a highly fragmented or powdered form, so that failure of the cladding could result in a significant fraction of the fuel itself being released."

The underlying concern identified here is a cladding failure source term release could exceed that of a fuel melt source term release. What should be considered is, the radiological consequences of a lessor and more likely accident may be the new "maximum credible accident."

Reports and studies (e.g., Resolution of Generic Safety Issues: Issue 170: Fuel Damage Criteria for High Burnup Fuel (Rev. 2)) have evaluated high-burnup fuel and approved higher burn-up levels, but they have neither disputed the fuel disintegration caused by high-burnup nor evaluated the consequences of a powdered fuel source term. Until this NUREG-1465 concern has been openly eliminated, any revision to RG 1.183 should include a powdered fuel source term.

Limited range of applicability on Non-LOCA release fractions

Notably, DG-1199 significantly increased Non-LOCA nobel gas release fractions (above RG 1.183 Revision 0) and returned them to NUREG-1465 levels.

Excessive MISV leakage rates and the TMI accident prompted control room habitability studies, regulation and modifications to install Control Room Emergency Ventilation/Filter Systems. Subsequently, RG 1.183 Revision 0 required Control Room Operator) doses to be evaluated for specific accidents, including the Non-LOCA fuel handling accident (FHA); however, missing from

RG 1.183 is a requirement to evaluate doses to those fuel handlers/workers that would be in close proximity to this accident. Given the concerns identified the NRC identified in Information Notice No. 90-08: "*KR-85 Hazards From Decayed Fuel*" and the doses to control room the doses these ground zero workers could exceed federal limits and threaten their health and safety.

Because the water in spent fuel pools will not prevent the release of nobel gas (Kr-85, a pure beta emitter) in a FHA (mechanical damage or overheating), revisions to RG 1.183 should require the analysis of local doses to ensure the safety of workers in the area at the time of the accident. Additionally, the Non-LOCA FHA source term and methodologies should be used to ensure the viability of FLEX actions to intended to mitigate an extended loss of spent fuel pool cooling.

DG-1199
In October 2009, the NRC issued for public comment DG-1199 as a proposed Rev. 1 of RG 1.183.
Staff received 150 public comments

The reasons for revision of RG 1.183 in DG-1199 were:

Providing additional guidance for modeling BWR MSIV leakage,

SAND2008-6601 determined RG 1.183 BWR MSIV leakage source terms and methodologies are "non-conservative and conceptually in error." These conceptual errors (and others) should be corrected in any revision to RG 1.183.

2019 License Amendment Requests

In 2019, NRC received several AST LARs requesting increased MSIV leakage
As a result, work on DG-1199 was postponed to allow NRC staff to incorporate lessons learned, from evaluation of the LARs, into the revised RG 1.183:

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Quad Cities Nuclear Power Station, Units 1 & 2 – Amendment Nos. 281 and 277 to increase allowable MSIV leakage, June 26, 2020 (ML20150A328)
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Dresden Nuclear Power Station, Units 2 & 3 – Amendments Nos. 272 and 265 to increase allowable MSIV leakage, October 23, 2020 (ML20265A240)

Does the NRC mean say LARs from last year (2019) cause a 10-year delay? DG-1199 was approved (but not issued) by the NRC in 2010. In consideration of "The NRC Approach to Open Government," please explain the 10-year delay.

Because SAND2008-6601 clearly explains/illustrates that RG 1.183 MSIV Leakage source terms and metrologies are "non-conservative and

conceptually in error," it does not seem that LARs to increase MSIV leakage are in the best interest of public health and safety.

The intent of the NRC staff is for RG 1.183 Rev. 0 and Rev. 1 to co- exist

According to RG 1.183, "T*he design basis accident source term is a fundamental assumption upon which a significant portion of the facility design is based."* Given this and SAND2008-6601, how does the existence (coexistence) and continued use of the non-conservative and conceptual errors in RG 1.183 benefit the health and safety of the public?

Revised Fuel Handling Accident

Revisited the original studies forming the technical basis for the FHA and incorporate updated information.

Model improvements established from the current understanding of reactor fuel pin physics and iodine chemistry under the environmental conditions in which fuel handling operations are taking place.

Concluded that considerable margin exists regarding the scrubbing effects of iodine in the spent fuel or reactor pool and that the current staff DBA FHA fission product transport model can be refined while still maintaining conservatism.

Reference: Memo from RES to NRR, "Closeout to Research Assistance Request for Independent Review of Regulatory and Technical Basis for Revising the Design-basis Accident Fuel Handling Accident," November 23, 2019 (ML19270E335)

While there may be margin regarding the scrubbing effects of iodine, there is no margin regarding the release of Kr-85 in a DBA FHA. Please consider DBA FHA doses to control room operators and extrapolate local area doses. No amount of water in spent fuel pools or the reactor pools, will shield or prevent the release of a nobel gas (Kr-85) in a DBA FHA (or other accidents that cause mechanical or overheating damage in these pools).

Consideration of "*KR-85 Hazards From Decayed Fuel*" (Information Notice No. 90-08) is conspicuously missing from RG 1.183 Revision 0. It should be included in any revision.

Over the last 10 years no applicant or licensee has adopted the methodology from SAND2008-6601, "Analysis of Main Steam Isolation Valve Leakage in Design Basis Accident Using MELCOR 1.8.6 and RADTRAD."

There have been no communications that applicants or licensees intend to adopt the SAND2008-6601 methodology.

SAND2008-6601 clearly explains/illustrates that RG 1.183 BWR MSIV source

terms and metrologies are "non-conservative and conceptually in error." It identifies a safety concern (with a complex array of regulatory implications); however, this concern was not enough to motivate nuclear power plant owners/operators to adopt SAND2008-6601 or otherwise correct the non-conservative errors in RG 1.183—that adversely affect the health and safety of the public. This is the crux of the matter and the reason for PRM-50-122.

From: Brian Magnuson
Sent: Wednesday, November 4, 2020 10:31 PM
To: Smith, Micheal
Cc: Blumberg, Mark; Meighan, Sean
Subject: Re: Regulatory Guide 1.183 Revision Public Meeting Notice

Micheal/Mark:

I appreciate the notification and plan to attend.

Thank you,
Brian

> On Nov 4, 2020, at 10:33, Smith, Micheal <Micheal.Smith@nrc.gov> wrote:
>
> Hello,
>
> My name is Micheal Smith and I am currently the project lead for the revision of Regulatory Guide 1.183. Mark Blumberg (project technical lead) informed me that you might be interested in the revision of RG 1.183 so I am reaching out to inform you that we have a public meeting scheduled for November 19th from 1pm -4pm EST. The link to the public meeting notice is below.
>
> https://www.nrc.gov/pmns/mtg?do=details&Code=20201297
>
> Enjoy the rest of your week!
>
> <image001.jpg>
>
> Micheal Smith

Health Physicist and Assistant Radiation Safety Officer
Radiation Protection and Consequence Branch
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Office of Nuclear Reactor Regulation
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301-415-3763